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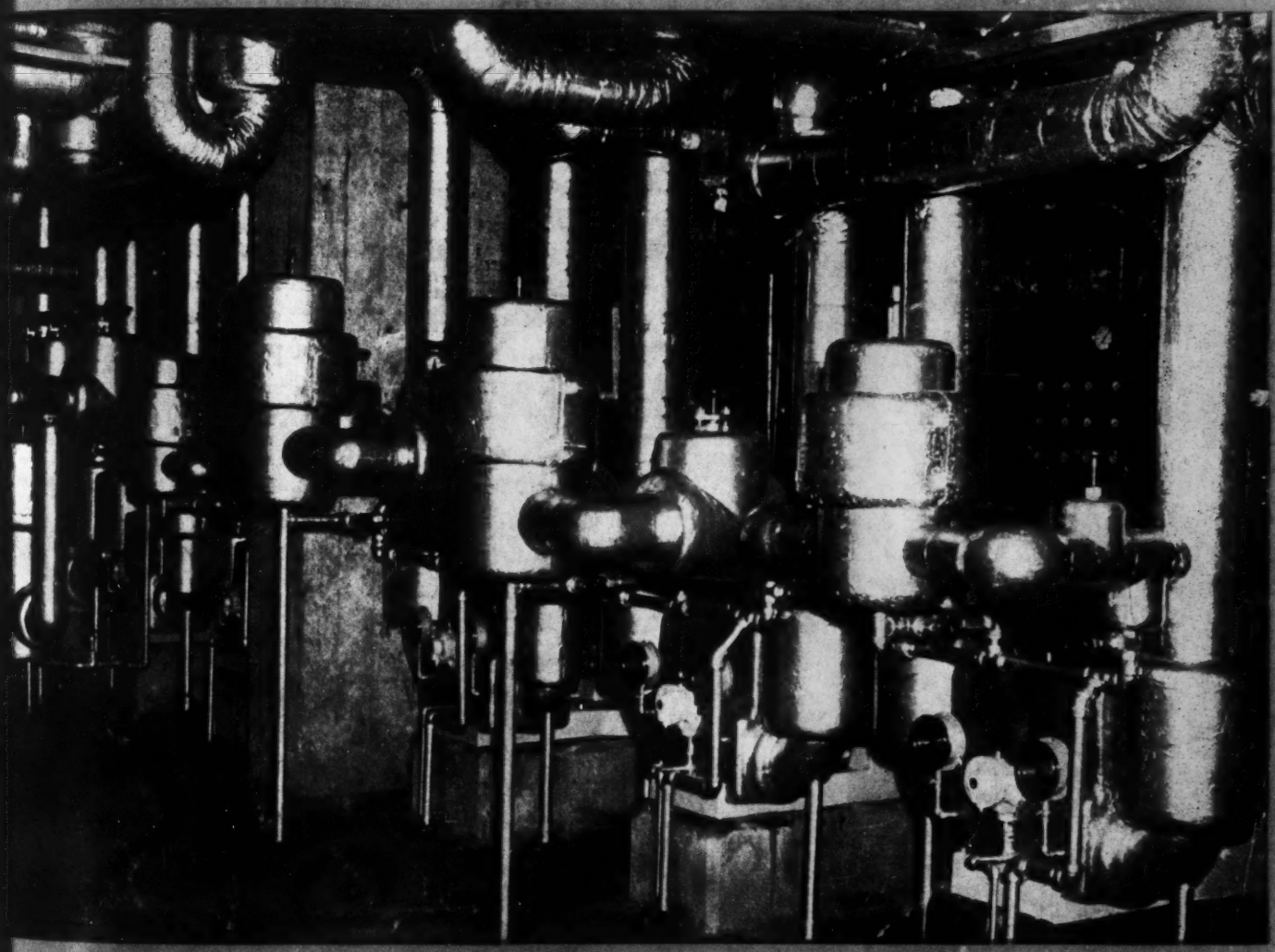
INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Volume 107 — Journal Section of the American Society of Heating and Ventilating Engineers



Robert J. Salinger describes this month the air conditioning and heating of one of the first of Houston's postwar buildings

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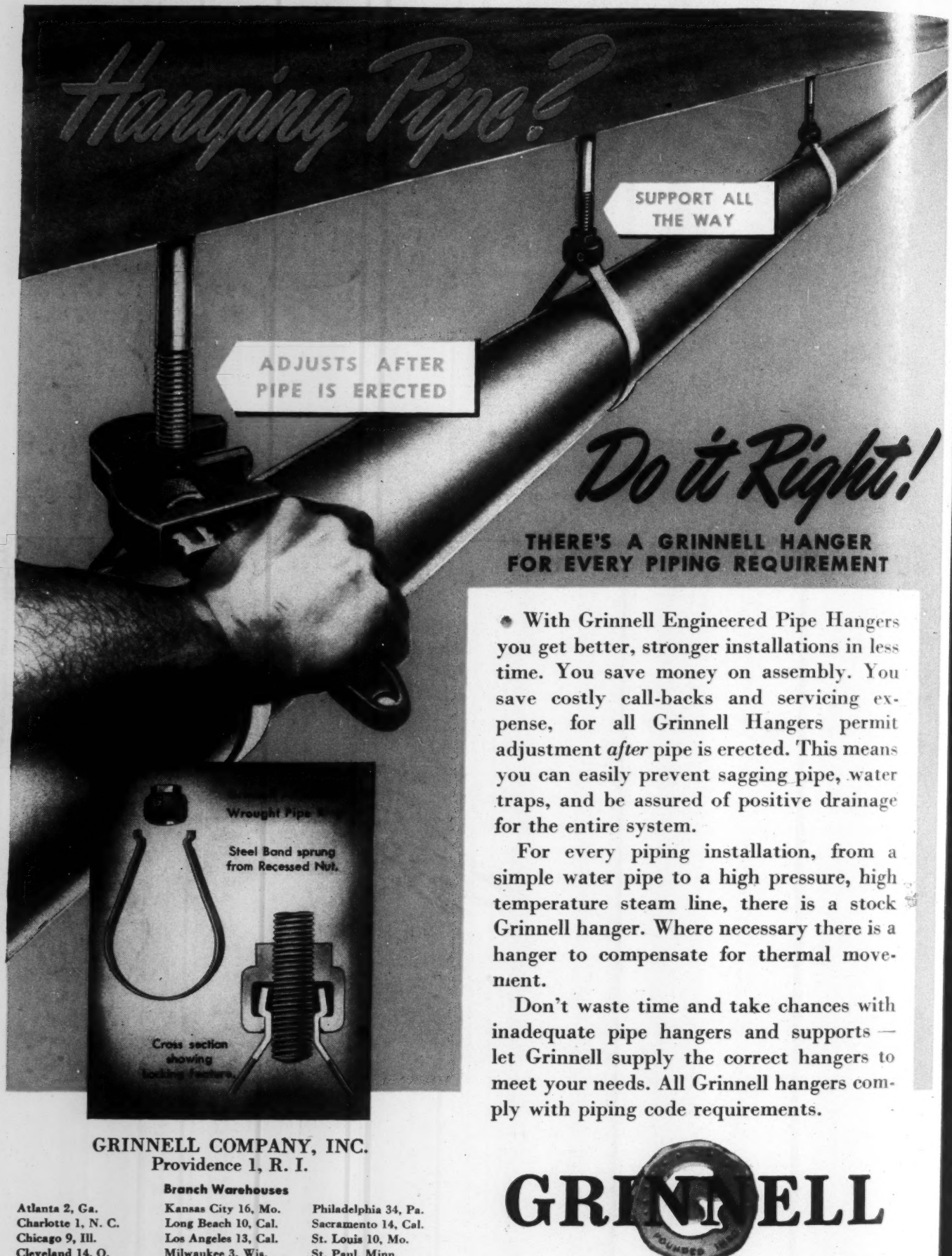
Hanging Pipe?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WHENEVER PIPING IS INVOLVED

THE EDITOR'S PAGES

INDEX TO HPAC READY SOON

An index to Heating, Piping & Air Conditioning—and to the Journal Section of the American Society of Heating and Ventilating Engineers—for the year 1947, Vol. 19, Nos. 1-12, will be ready soon and will be available to subscribers without charge on request.

Please advise The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, if you want a copy of this index mailed to you.

BUILDINGS OBSOLETE WITHOUT CONDITIONING

Air conditioning is now regarded as a basic necessity in the design of new office buildings, hotels, and other public gathering places, members of the staff of Guy B. Panero, engineers, New York City, declare after a survey of members of the organization on 1948 trends in air conditioning and heating.

The Panero organization has designed air conditioning systems for many leading building projects, including the Rockefeller Center development, the Metropolitan Life building, the National Gallery of Art in Washington, and the Museum of Modern Art in New York.

"Very few owners of new buildings are overlooking air conditioning," according to the report issued by the firm. "It is simply a matter of economics—they realize that without air conditioning, a hotel, office building, department store, restaurant, or any other public meeting place cannot be regarded as a 'first class' establishment. In fact, owners and investors realize that without air conditioning a building is obsolete before it is completed."

The demand for home air conditioning units is increasing, according to Ernest Williams, leading authority on air conditioning and a member of the Panero organization, who predicts that "home air conditioning units will be as popular as radio sets in the not distant future."

One of the most important mechanical trends in the air conditioning field is the serious consideration of the use of panel cooling, which is panel heating in reverse, according to Mr. Williams.

"The big detriment in the use of panel cooling," Mr. Williams believes, "is the condensation of humidity on the panels when the panel surface is below the dew point temperature of the surrounding air. However, a way has been found to overcome this by a separate introduction of cooled or cooled and dehumidified air into the occupied spaces with the newly-introduced air so processed as to keep the dew point below that of the surface temperature of the cooled panels."

In the heating field, "the principal new trend in heating large buildings centers around the use of the same distribution system to supply warm air in winter as well as cool air in summer," according to the Panero organization, which designed its first system utilizing this new versatile equipment during 1947, and which has been highly satisfactory in both hot and cold weather.

CONDENSING UNIT STANDARDS DEVELOPING

The first of a series of recommended standards for the commercial refrigeration industry—this one dealing with open type condensing units—was brought near completion at a third industry-wide meetting held recently at the Neil House in Columbus, Ohio.

At the same session it was reported that "considerable progress was made toward the formation of a recommended industry standard for hermetic type refrigeration condensing units."

Those attending the meeting were members of the joint engineering committee of the small condensing unit industry, representing both the Air Conditioning & Refrigerating Machinery Association and the Refrigeration Equipment Manufacturers Association.

The proposed draft of the recommended industry standard on open type condensing units was circulated prior to the Columbus meeting throughout both the refrigeration and electric motor industries. Considerable time was spent at the session in reviewing comments of the National Electrical Manufacturers Association, the American Institute of Electrical Engineers, and the motor division of General Electric Co.

Another meeting of the joint engineering committee has been called for March 22 and 23 at the Palmer House in Chicago to review a draft of the recommended industry standard for hermetic type condensing units.

REPORT ON NEW YORK MEETING TO APPEAR

The complete "proceedings" of the 54th annual meeting of the American Society of Heating and Ventilating Engineers, held in New York City the first few days of this month, a story on the entertainment functions, and a report on "side-line" activities will be published in the ASHVE Journal Section of HPAC. Some of the technical papers presented at the meeting have already been published in the Journal Section. Others are given this month, and the rest will be printed in future issues.

The 8th International Heating, Ventilating, and Air Conditioning Exposition, which is sponsored by the ASHVE, was held in conjunction with the meeting and a "preview" of exhibits was published in a special Show Section in our January number. Further details of the new and improved products displayed at the exposition will be given in our Equipment Developments section.

It has been announced that the ASHVE's 55th annual meeting—and the 9th International Heating, Ventilating, and Air Conditioning Exposition—will be held in Chicago the latter part of January 1949.

GROUNDWATER USE WITHOUT PUMPING FROM WELL

In G. E. Clancy's article in the December 1947 HPAC, it was erroneously stated on page 92 that a patent had been applied for the arrangement shown in Fig. 3 of the article.

No patent application has been made by the author in the case wherein compressed air is used for agitation of the water in the well to effect a higher rate of heat transmission.

THE EDITOR'S PAGES

INDUSTRIAL BUILDING TO CONTINUE HIGH

The volume of industrial engineering and construction will continue at a high level in 1948, and especially so in the chemical processing industries, according to a survey of executives of the H. K. Ferguson Co., industrial engineers and builders of Cleveland, New York, Cincinnati, and Houston. Those polled in the survey were unanimous in the opinion that there is still a large backlog of industrial construction. Obsolescence and deferred requirements will, in their opinion, necessitate the continuance of industrial construction at a high level during 1948.

Other pertinent observations:

Cost stabilization is more likely today than a year ago.

Both labor and management will make concerted efforts to increase productivity.

There is still a scarcity of engineering and design talent. There are also critical shortages of bricklayers and pipefitters, though labor in general is becoming increasingly available.

There is increasing interest in the foreign market for engineering and building services—this is a result of the Marshall plan proposal.

U.S. INDUSTRIAL OUTPUT BREAKS ALL-TIME RECORD

The second peacetime year found American industry smashing all previous production records. Regrouping productive capacities and resources on a scale heretofore unheard of in any national economy made possible the new highs, according to an "industry report," appearing in the January issues of World's Business and Guia, export business publications.

With some $75 billion worth of manufacturing plants, an average of $6 thousand worth of tools and 4 hp of electrical and mechanical energy per factory worker, the gross national product of the United States by the end of 1947 was $235 billion—an increase of $40 billion over the previous 12 months. Approximately $30 billion investment in new plants and equipment in the last two years, plus the facilities of wartime expansion, have raised the productive capacity of American industry to a level 70 percent greater than that of 1939, according to the report.

EVENING COURSE ON HEAT PUMP AT NYU

New York University's college of engineering is offering an evening course on the heat pump during the second term of the 1947-8 school year.

Under the direction of Professor E. N. Kemler, research professor of mechanical engineering and assistant director of research of the college, studies will be concerned with heat pump design, application, and theory. Reversed refrigeration as a source of heat for homes, commercial establishments, and industrial processes will be considered.

LOUIS F. HUDEPOHL DIES AT 47

Louis F. Hudepohl, national treasurer of the Heating, Piping and Air Conditioning Contractors National Association, died at the age of 47 on December 24 after a short illness. He was president of T. J. Conner, Inc., heating and air conditioning contractors, Cincinnati.

Members of the HPACCNA will remember the excellent program of the 1947 annual convention in Cincinnati, when Mr. Hudepohl served as chairman of the convention committee. He had been a director of the national association since 1939 and was serving a second term as treasurer at the time of his death.

George P. Nachman, of Cleveland, has been named to serve the unexpired term as national treasurer.

CONVECTOR STANDARD NOW IN PRINT

Printed copies of commercial standard CS140-47, testing and rating convectors, are now available according to an announcement by the commodity standards division of the National Bureau of Standards. Copies are for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 10 cents each.

This voluntary standard, developed by the industry in cooperation with the commodity standards division, covers methods of testing and rating cast iron and nonferrous steam and hot water convectors used for heating rooms. It also covers procedure in obtaining approval of ratings to be published and a uniform method of manifesting compliance with the standard. The standard makes available a method for rating convectors which takes into consideration the condensation or water heat capacity and a heating effect evaluation found to be generally acceptable.

PLANS TO DOUBLE SALES VOLUME

National expansion plans call for the Frigidaire Div. of General Motors to "double" its sales volume of commercial refrigeration and air conditioning equipment in 1948, according to W. F. Switzer, commercial sales manager, during a series of five regional commercial meetings conducted for key personnel from coast to coast in January.

At the same time Mr. Switzer warned district representatives that the commercial phase of the business is already face-to-face with a normal buyers' market. "We must greatly strengthen our retail organizations," he urged, "and must forge hard-hitting, down-to-earth sales and service plans to cope successfully with competitive days ahead."

COPPER TUBE STANDARD PROPOSED

A proposed simplified practice recommendation for copper and copper alloy round seamless tube has been submitted to producers, distributors, and users for approval or comment, according to an announcement of the commodity standards division of the National Bureau of Standards, Washington 25, D. C.

Proposed by the Copper and Brass Research Association, the recommendation lists preferred outside diameters and wall thicknesses for tube.

Heating Piping & Air Conditioning

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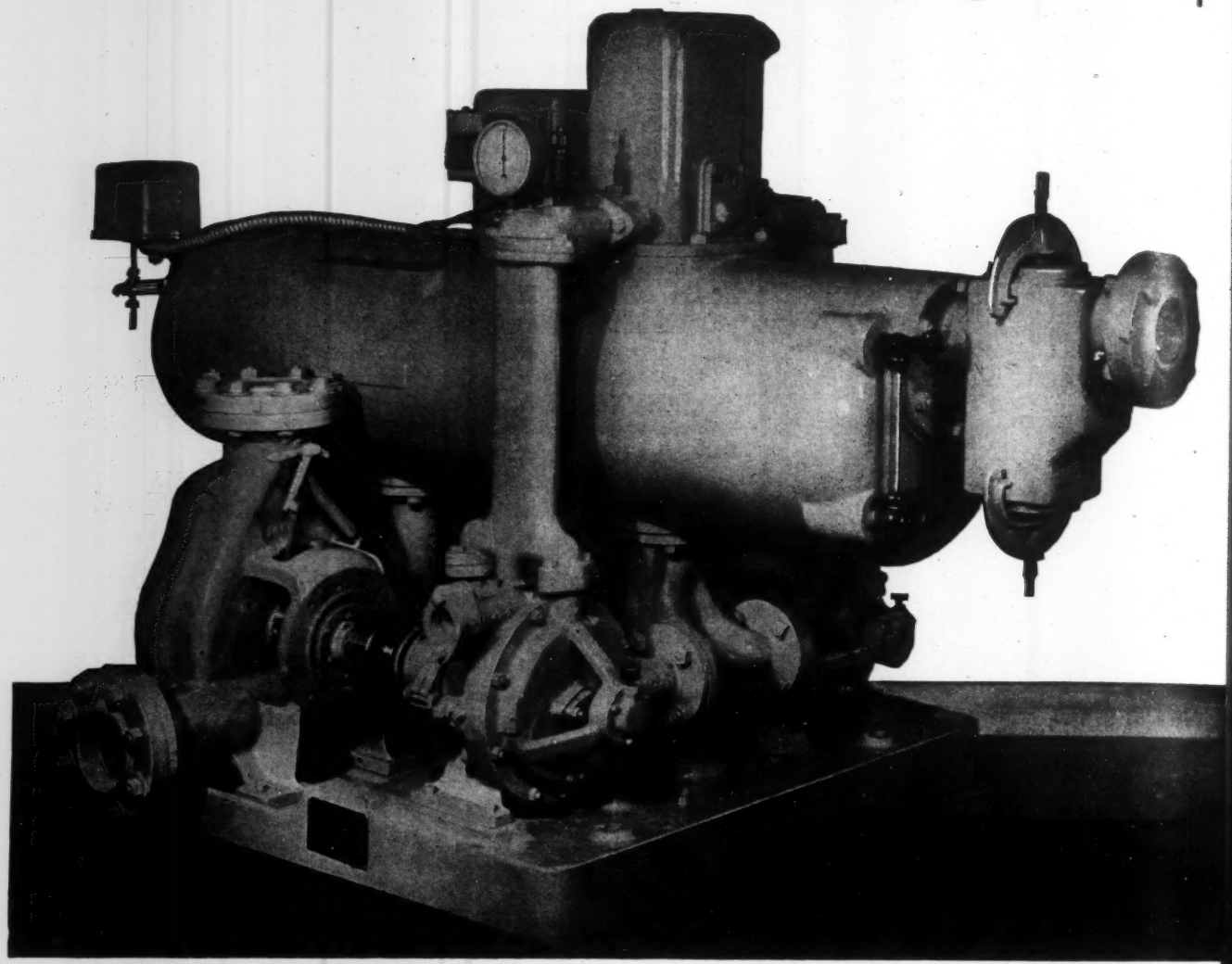
Where Heat Must Not Fail—
Install this SAFE Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is entirely independent of electric current failure, and continues to operate as long as there is steam in the system.

More than that, the Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump.

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THE NASH ENGINEERING COMPANY

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Flexibility in Air Conditioning Features New Houston Building

ONE OF THE first of the postwar office buildings to be completed in Houston, Texas, is the 22 story City National Bank building, an outstanding example of functional and artistic design executed by Alfred C. Finn and Robert J. Cummins, associated architect and engineer. The bank—which is the result of the vision and leadership of Judge James A. Elkins—occupies the first three floors and a portion of the basement along with Corrigan's, an exclusive jewelry store. The main banking room, extending through three stories, presents quite a contrast to the oldtime bank with its brass cages. There are no cages or enclosures of any type, merely a series of marble counters with tellers behind them to serve the many depositors of this rapidly growing institution.

The bank and the jewelry store are conditioned by a number of dry coil units supplied with chilled water and utilizing a conventional duct system. The floors above the bank are divided into offices of various sizes for various uses; these are conditioned by means of a high pressure conduit system for the exterior zones and a conventional duct system for the interior zone.

Even though the interior zone and lower floor air conditioning is called "conventional," there is one feature that is somewhat unconventional—every cubic foot of outside air brought into the building for air conditioning (a total of 97,320 cfm) is taken in at the 14th floor and filtered, heated or cooled, humidified or dehumidified, and reheated, as required, before being circulated to the various locations throughout the building. There is one dehumidifier and fan which supplies this conditioned "primary" air to all of the conventional units in the building. There are two dehumidifiers and four fans which supply this conditioned primary air under high pressure to the second-

The air entrance for the cooling tower is worked into the lattice design in keeping with the architecture of the building

ROBERT J. SALINGER, chief engineer, office of Reg F. Taylor, consulting engineer, Houston, describes the air conditioning and heating of one of the first of that city's postwar structures—the 22 story City National Bank building. The bank and a jewelry store are handled by a conventional duct system, and the upper office floors are served by a high pressure conduit system for the exterior zones and a conventional duct system for the interior zone. The air conditioning was designed to permit flexibility in the arrangement of office areas, and to coordinate with the architectural treatment

ary units located under practically every window above the third floor. The quality of this air is controlled during the cooling and heating seasons to provide for all dehumidification or humidification necessary, so that the coils in the window units and in the dry coil type fan units are used for sensible cooling or heating only.

There is an interior unit on each floor above the third, four for the main banking room and offices, one for the bank basement space, and three for the jewelry store. The window units are of the exposed cabinet type containing a sound absorber plenum and jets through which the primary air, under pressure, is forced, thus creating an induction of air through the secondary coil in the face of the unit. This induced room air is mixed with the primary air in the ratio of ¼ primary and ¾ room air.

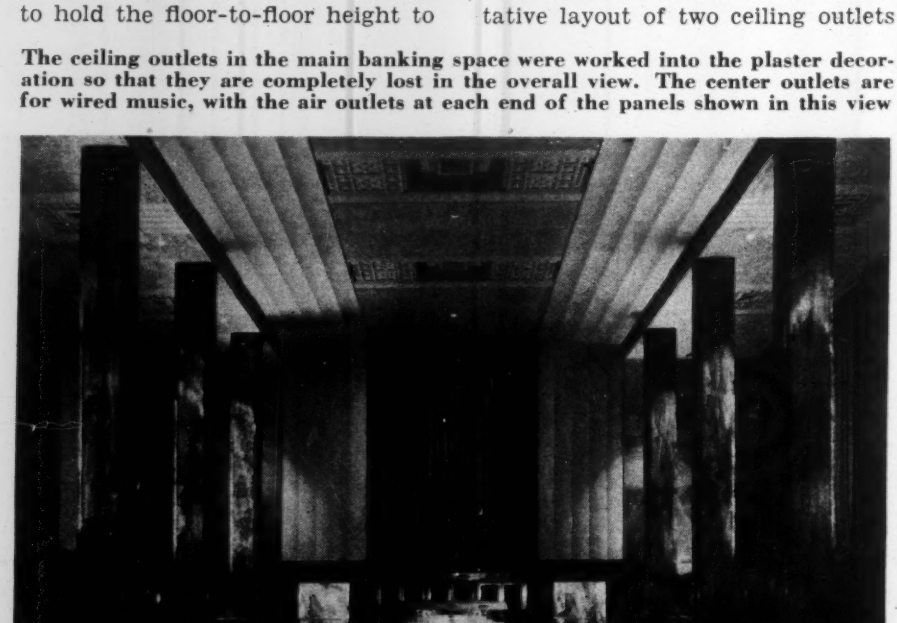
Floor-to-Floor Height Held to Minimum

In order to obtain the most economical building in the face of rising building costs, it was necessary to hold the floor-to-floor height to an absolute minimum and still provide extreme flexibility to suit individual tenant requirements. To this end, and with the fullest cooperation of the architect and the structural engineer, it was decided to set a story height of 11 ft, 3 in. with a floor to ceiling height of 9 ft, 0 in. In order to cut the beam depths to a minimum and reduce column size, a cellular steel floor was used which also contains the electrical distribution system. With this floor, it is possible to provide 120 volt alternating current, signal, or telephone connection at any point in any office. The air conduits and water pipes for the exterior window units run in the furred ceiling under the floor supplied and the interior zone ductwork runs in the furred ceiling over the floor supplied. The entire furred ceiling is used as a return plenum with return air entering the plenum through the center of combination ceiling diffusers.

Since it was necessary to design an interior duct system to suit any office arrangement either originally or in the future, a system of typical main ducts was laid out with a tentative layout of two ceiling outlets per bay. From this as a base the runout from the main and the number of outlets required could be added as each space was leased. Since the ceiling height of the entire floor is constant, the arrangement of corridors could be changed or omitted entirely.

The only portions of the floor which were predetermined were the elevator shafts, the stairways, the toilet rooms, and the interior air conditioning unit room. Since some tenants occupy an entire floor even the corridor arrangement is not typical. The building is almost completely occupied and in no case was it necessary to make a change to the original main ducts, thereby proving the effectiveness and flexibility of the basic design.

The ceiling outlets in the main banking space were worked into the plaster decoration so that they are completely lost in the overall view. The center outlets are for wired music, with the air outlets at each end of the panels shown in this view

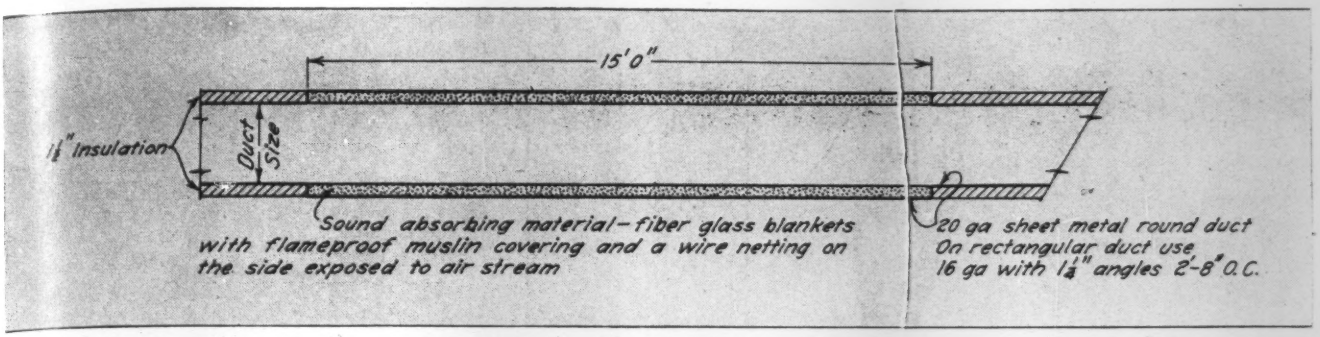


700 Hp and 500 Hp Centrifugal Compressors

Cooling and dehumidification of the primary air is obtained by the circulation of water cooled by a 700 hp and a 500 hp centrifugal compressor. The temperature of the water to the primary dehumidifiers is controlled to hold the apparatus dew point of the air leaving these dehumidifiers in the cooling season at 50 F; the water enters at 43 F and leaves at approximately 51 F. This water is then returned to the basement where it is supplied to seven zone pumps, of which four are for the four exterior zones, one for the interior zone for the office floors, one the bank zone, and one for the jewelry store zone.

How Zone Temperatures Are Controlled

The temperature of the water required for each of the four exterior zones is determined by four exterior thermostats located in glass front housings facing in the same direction as the respective zone. This controller resets a submaster controller which determines the amount of water returning from the zone to be mixed with the water returning from the primary dehumidifiers. In this manner the temperature of each zone is held constant regardless of the outside temperature variations. At each window unit is a manual control valve on the water line so that the tenant has individual control if the zone control is not satisfactory for his particular comfort.


15'0"
1½" Insulation
Duct Size
Sound absorbing material – fiber glass blankets with flameproof muslin covering and a wire netting on the side exposed to air stream
20 ga sheet metal round duct
On rectangular duct use
16 ga with 1¼" angles 2'-8" O.C.

Sound absorber section used at discharge of primary fans

The interior zone water temperature is determined by the north zone thermostat and the temperature of the air supplied to the zone is regulated by a return air thermostat controlling a three-way mixing valve at each unit.

In winter, the heating of the primary air is accomplished by steam preheat and reheat coils and the zone water is heated by a steam exchanger and mixed with return water as dictated by the outside thermostats. It is possible during the heating and intermediate seasons to provide cooling in the interior zone and heating in any or all of the exterior zones. This is quite normal operation, as the interior load is made up almost exclusively of population and lighting which is constant without regard to outside temperature changes.

Air Outlets Blend with Architectural Treatment

In order to conform to the architectural treatment of the ceiling in the main banking room and the building lobby, rectangular or square ceiling outlets were used. Above the main banking room is a high attic space caused by the heavy girders used to span between the heavy columns to provide an unobstructed space. This attic space is used for the bank's air conditioning units and supply ducts. The return air is taken for the most part at the floor along the outside wall. The ceiling outlets have been worked into the plaster decorations on the ceiling so that they are completely lost in the overall view.

While everyone admits the necessity of having air outlets in an air conditioning system, there is no reason to spoil the eye appeal of a room as rich and beautiful as the main banking room with incongruous outlets. As air conditioning engineers, we insist on cooperation by the architects, but in cases such as this, we, too, must cooperate so as not to detract from a carefully designed decorative effect.

Another example of this necessary cooperation was demonstrated in the treatment of the first floor and basement salesrooms of the jewelry store. Here, in addition to working into the architectural design, the air outlets had to be installed so as to permit the proper locating of lighting outlets, which in this case are of several different types; there are recessed fluorescent fixtures, recessed incandescent fixtures with lenses, spot lights, and lighting coves. All of the lighting was designed and installed to best display the articles for sale, and the air conditioning had to be subordinated to the requirements of the tenant occupying the space.

Another point of interest in regard to the jewelry store, and one that is quite often overlooked, is the ventilating of the show windows. Proper display means increased sales, and the use of high intensity lighting in the show windows results in an excess of heat. This is cared for by taking room air and letting it pass into the windows from which it is exhausted by two centrifugal fans. By the proper cooling of the windows, the life of the light bulbs is increased and there is no damage to merchandise due to excessive heat.

Ventilating the Bank Vault

Another unusual part of the design of the system is the air conditioning of the bank vault. This vault is really two vaults, one part of which is the shiny stainless steel portion devoted to safety deposit boxes, and the other the much more simple but just as necessary cash vault for the bank.

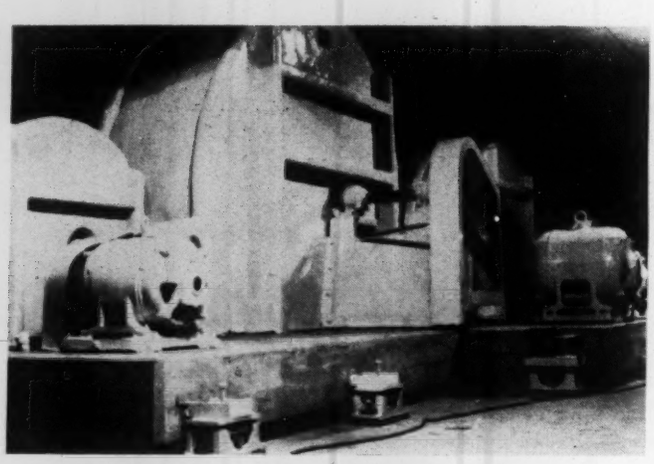
Since any permanent connection would not permit burglar- or fireproof construction, a removable connection is used. The ductwork in the safety deposit portion is concealed above the stainless steel ceiling, and in the cash vault above a plaster ceiling. This ductwork terminates at the rear door of the cash vault with a counterbalanced gasketed stainless steel boot which can be swung into the vault at night and can be swung up to connect to a part of the permanent duct system outside the vault during the day. In this way, comfort and protection are both served.

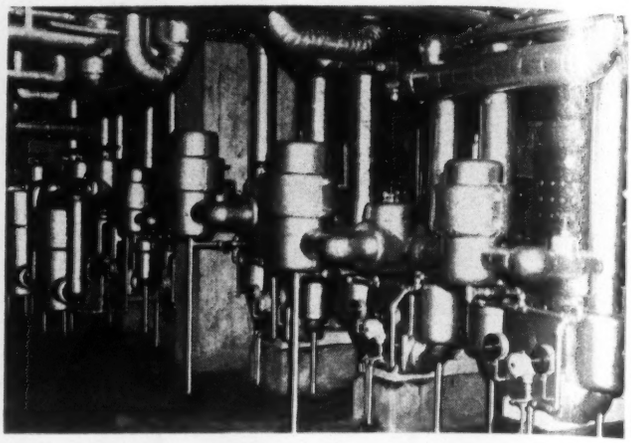
Heating Is All Indirect

The heating system is unique in that all heating is done by steam to water exchangers or direct steam coils. There is not a single convector or radiator in the entire building. Since all of the toilet rooms are inside spaces, these are heated by exhausting corridor air through them and exhausting this air by means of fan and duct systems at the cooling tower level above the 23rd floor. The entrances are all of the double door type and the main entrance is supplied with air from the lobby conditioning unit.

Due to the proximity of an adjacent building, it was impossible to provide a pit in the basement to permit the installation of the standard high firebox type, low pressure boilers. To meet this condition, scotch marine boilers were used with the resultant saving in headroom.

The cooling tower posed a problem that taxed the ingenuity of the architect to provide sufficient floor space, free area to obtain air into the tower, proper support for the heavy load—and still not affecting the basic design of the building. That this was accomplished can be





Left: The primary air fans are in the 14th floor equipment room. Right: Temperature of the chilled water to the primary dehumidifiers is controlled to hold the apparatus dew point of the air leaving these dehumidifiers to 50 F. The water then goes to the seven zone pumps in the basement. This picture shows the zone pumps and the water filters for 10 percent of the water circulated

seen from the exterior view of the structure. The cooling tower is actually built around the column and beams which tie the high walls together concealing the tower. The air entrance worked into the lattice design is in keeping with the architecture of the building. The space around the tower is not excessive but is sufficient.

Separate Unit Serves FM Station

One of the later additions to the building was the control room for an FM radio broadcasting station and the 20 in. diameter mast reaching 343 ft above the sidewalk level. Due to the requirement for air conditioning 24 hr a day, this load is served by a direct expansion unit, with steam for winter heating.

This brings to mind the question as to whether it is economical to operate an air conditioning plant as herein described 24 hr a day or whether it should be turned off at 5:00 p.m. when most of the tenants go home. It is thought that running all night at reduced tonnage to be able to hold the humidity down and not permit the result of late afternoon sun effect to cause the build up of sensible heat is economically sound, but to convince an owner is sometimes quite difficult. It is hoped that some definite data on the overall cost of operation both ways can be obtained soon.

All mechanical work—including plumbing, heating, ventilation, and air conditioning—was designed by the office of Reg F. Taylor, consulting mechanical engineer, and installed by C. Wallace Plumbing Co.

Refrigeration Safety Code Being Revised

UP-TO-DATE provisions for the safe use and application of mechanical refrigeration are being prepared by a nationally representative committee working under the leadership of the American Society of Refrigerating Engineers. The committee has been reorganized by the American Standards Association to undertake a revision of the 1939 American Standard Safety Code for Mechanical Refrigeration. The code is being revised with two purposes in mind: (1) to put it in a form that will be most easily used by municipal and state authorities; (2) to bring it up-to-date so that safety requirements will be applicable to all the new types of refrigeration equipment.

In reorganizing the committee, under the sponsorship of the ASRE, active new members were added and additional organizations were included to represent the new developments in mechanical refrigeration. The committee now is representative of manufacturers of refrigeration equipment, contractors, users of the equipment, safety and insurance organizations, and government departments.

Dr. William R. Hainsworth, representing the ASRE, is chairman of the reorganized committee; Harry D. Edwards, International Acetylene Association and National Safety Council, is first vice chairman; E. T. Benson, Air Conditioning and Refrigerating Machinery Association, is second vice chairman; and D. F. Hayes, ASA, is secretary.

A subcommittee has been appointed for the redrafting of the code and this subcommittee is already actively at work. Subcommittees are also working on provisions for safety valves and on unfired pressure vessels. A subcommittee has also been appointed to keep in touch with cities that are considering changes in their refrigeration codes.

The broad application of the revised code is indicated in the fact that it is expected to cover the installation of refrigeration in institutions, places of public assembly, commercial establishments, industrial occupancies and residences.

Reviews Changes in PIPING CODE

The supplements answer numerous inquiries

THE CURRENT edition of the American Standard Code for Pressure Piping, ASA B31.1—1942, was published late in that year and copies were distributed starting early in 1943. As would be expected, there have been numerous inquiries concerning the scope and intent of code requirements. Changes and additions resulting from these inquiries were referred to the members of sectional committee B31 for vote on approval and were published as supplements Nos. 1 and 2 that were issued in 1944 and 1947 respectively. Other inquiries needing explanation only were answered by the respective subcommittees or their officers. Also, several inquiries for which there was no immediate solution have been held over pending the next general revision of the code.

A brief account of the principal revisions and additions may be of assistance to some having occasion to use the code, or serve to bring new features to the attention of others who may not as yet be aware of their existence.

Supplement No. 1, issued in November 1944 and included in a recent reprinting of the code, made reference to the American War Standard for Straight Screw Threads for High Temperature Bolting (ASA B1.4—1942) which has since become the American Standard Screw Threads for High Strength Bolting, (ASA B1.4—1945). Other changes presented in this supplement were the referencing of the new American Standard (ASA A21.2) for pit cast, cast iron pipe in sections 1, 2, and 3 of the code, and several minor revisions of section 3 on oil piping.

Supplement No. 2, approved in April 1947 and available for distribution in July, contained more extensive changes embodying new material that had been developed by subcommittees subsequent to publication of the 1942 edition of the piping code. The most extensive change was the inclusion of requirements for instrument and control piping in sections 1 to 5 inclusive with the listing of additional specifications and *S*-values therefore in section 7 on materials and elsewhere.

As stated in each section affected (1 to 5 inclusive) the requirements apply to the design of instrument and control piping for safe and proper operation of the piping itself and do not cover the design of piping to secure proper functioning of the instruments for which the piping is installed. Size limitations are set up with a view to providing sufficient mechanical strength and to prevent clogging due to corrosion or other factors that might impair operation of instruments or control. Design is based on the actual pressures and temperatures to which the material is normally subject with due recognition of the less severe conditions obtaining in dead end service where higher temperatures are experienced only occasionally when blowing out the line. A valve suitable to withstand full line pressure and temperature, however, must be provided as close as practicable to the take-off connection.

Another important feature of supplement No. 2 is the substitution of a single new formula for pipe wall thickness in place of the two formulas previously used in section 1 (power piping) and section 4 (district heating piping). This change keeps pace with a similar revision of the American Society of Mechanical Engineers' Boiler Construction Code. The new formula also has been substituted for the single formula previously used in section 5 of the piping code on refrigeration piping.

Bolting Flanges Together

In section 6, on fabrication details, more explicit requirements have been provided to govern the bolting together of two bronze or two cast iron flanges, or of one cast iron and one steel flange, with a view to preventing cracked flanges when pulling up the bolts. Consideration has been given to the type of facing, the diameter of the gasket, and the kind of bolts used, and appropriate rules have been set up for different combinations of these.

For welded construction, the requirements on stress relieving have been revised, and several more details added for acceptable types of welded branch connections for pipe sizes ⅛ in. to 3 in., inclusive.

Copies of supplements 1 and 2 to the American Standard Code for Pressure Piping can be obtained from the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y., for 10 cents and 60 cents, respectively. Everyone having occasion to use the code is urged to obtain copies of these supplements and become familiar with the important changes therein contained.

SABIN CROCKER, chairman of the subcommittee on scope and intent of the American Standards Association sectional committee B31 on the Code for Pressure Piping; mechanical engineer, Ebasco Services, Inc.; and member of HPAC's board of consulting and contributing editors, reviews here recent changes in this important piping code as covered in supplements

Sets Up Operating, Maintenance Schedules for Air Conditioning

IT HAS BEEN recognized at Eli Lilly and Co., Indianapolis, that the most efficient air conditioning practice is to anticipate breakdowns, thereby obviating costly repairs, lost production time, and the necessity of revised production and shipping schedules of materials delayed because of breakdowns. Consequently, an attempt has been made to provide inspection schedules whereby each piece of equipment and the system as a whole will be inspected often enough to keep it at its highest level of efficiency and provide the room conditions required for production.

Weekly Operating Schedules

In order for air conditioning systems to operate as designed, they must be kept in proper adjustment. In other words, the dampers should be set as designed, filters should clean the air and not be allowed to become too dirty, cooling coils should function efficiently, compressors and fans should run continuously, and reheat coils should operate as desired. In order to achieve control over the operation of the system, we have devised weekly operating schedules designed to enable a refrigeration mechanic to record daily dry bulb and wet bulb readings of outside and room conditions, and check the oil level and the head and suction pressures on the refrigeration compressors. Other items which need to be checked but once a week are also included on this sheet.

The dry bulb and wet bulb readings are submitted to the engineering department where they are plotted on a continuous graph so that any discrepancies can be readily discerned.

This schedule is particularly helpful in severe summer weather when it is necessary to keep the air conditioning systems in as fine a balance as possible in order to attain peak cooling and dehumidifying efficiency.

Occasionally, a call is received from the production department that a given system is not producing desired room conditions for the product being manufactured, and when the system is checked, it is found that one piece of equipment in the system is not in operation for one reason or another. This causes embarrassment to the engineering department as well as consternation to the pharmaceutical department and lost production time—and it ultimately results in money loss to the company.

It can be appreciated that it would be extremely hard to cool a room on a hot day if steam were on a coil in the supply air or if the supply fan were shut off. This weekly schedule helps to prevent such irregularities.

We have found that it is much easier to overlook discrepancies in an air conditioning installation if we have no check-off list, but that it is exceedingly rare to miss a point if we have an adequate check-off sheet. The Army and Navy air forces have recognized this fact and have provided check-off lists for pilots to use before taking off in planes.

B. G. EVANS, engineering dept., Eli Lilly and Co., Indianapolis, describes here weekly and monthly air conditioning operation and maintenance schedules, use of which has just recently been inaugurated. It is good business to locate trouble before it occurs, rather than to wait until a system has broken down before parts are ordered and repair work started, and these forms help to do so.

Monthly Maintenance Schedule

Every piece of mechanical equipment is subject to wear, distortion, or misalignment, and must be inspected periodically to ascertain the extent to which the equipment is in need of repair or replacement. We have worked up a monthly preventive maintenance schedule on our air conditioning equipment which itemizes those parts that should be checked monthly and others which should be checked annually. Each machine and each unit is carefully inspected both visually and aurally, and if found defective in any way is repaired or replaced.

We have listed our compressors according to models, and have ordered repair parts for each size or group of compressors. We have made no attempt to provide a complete set of replacement parts for each compressor, but rather have secured one set of recommended repair parts for each group. The parts which we have procured for replacement have been recommended by the manufacturers of the equipment as those parts which are likely to be in need of being replaced or subject to excessive wear or breakage. This collection of spare parts enables us to put a system back in operation quickly after some vital part has broken down, and saves the time which would otherwise be lost until a repair part could be procured from the manufacturer.

Weekly Operation Report — Air Conditioning Systems

Date_____ Room Conditioned_____
Signed_____ Location_____

	Mon.	Tue.	Wed.	Thu.	Fri.
Outside DB					
Outside WB					
Room DB					
Room WB					
Compressor Oil Level					
Compressor Head Pressure					
Compressor Suction Pressure					

Setting of outside air dampers	Open / Medium / Closed
Setting of return air dampers	Open / Medium / Closed
Preheating Coil	
Is coil leaking?	Yes / No
Temperature	In / Out
Trap	Working / Stuck
Operation of automatic valve	Free / Stuck
Hand valve	Open / Closed

Filter	Clean / Dirty
Supply Fan	
Running Correct direction	Yes / No
Belts	Tight / Loose / Lined-up / Worn / OK
Bearing	Hot / OK / Need Oil
Shaft	OK / Vibrating
"Freon" Coil	
Temperature	In / Out

Expansion Valves	
Setting Bulb Tight correct pos.	OK / Not OK
"Freon" solenoid valve	OK / Stuck
Water in drip pan	Yes / No
Condition of drain	Bad / OK
Water Coil	
Temperature	In / Out
Hand valves set	OK / Not OK
Automatic controls	OK / Not OK
Dehumidifier	
Temperature	In / Out
Sprays	OK / Not OK
Water	Clean / Dirty
Room supply air temperature	

Water Cooled Condensers	
Temperature water	In / Out
Water regulating valve	Check and adjust if necessary
"Freon" liquid level	High / Low / Normal
"Freon" line strainer (by touch)	Clean / Dirty
Dehydrator (by touch)	Clean / Dirty
Compressor	
Drive belts	Loose / Tight / Normal
Any visual oil leaks?	Yes / No
Is machine clean?	Yes / No

Weekly Operation Report — Air Conditioning Systems

Date_____ Room Conditioned_____
Signed_____ Location_____

Silica Gel	
Is steam on coil?	Yes / No
Setting of reactivated air damper	Open / Closed
Setting of leaving air damper	Open / Closed
Setting of reactivation discharge damper	Open / Closed
Temperature of air entering unit	
Temperature of air leaving unit	
Drum drive working and in good condition	Yes / No
Is fan running?	Yes / No
Condition of fan drive	Faulty / Normal
Is drum rotating in proper direction?	Yes / No
Setting of slide damper to reactivation air chamber	Open / Medium / Closed

Lithium Chloride	
Temperature of lithium chloride	
Specific gravity of lithium chloride	
Condition of lithium chloride filter	Dirty / Clean
Is reactivation fan running?	Yes / No
Pressure on reactivation nozzles	
Pressure on drying nozzles	
Float control height for contact	
Temperature of chill water to lithium chloride	
Condition of reactivation air filter	Dirty / Clean

Activated Alumina	
Temperature of return air to dryer	
Temperature of air leaving dryer	
Temperature of water entering cooling coil	
Temperature of water leaving cooling coil	
Temperature of air leaving cooling coil	
Is steam on the reactivation air coil?	Yes / No
Is the fan running?	Yes / No
Temperature of air leaving reactivation fan	
Cycle time on the unit in minutes	

Monthly Maintenance Report
Air Conditioning Systems

Date_____ Room Conditioned_____
Signed_____ Location_____

Outside Air Dampers	
Damper	Binding / Free
Damper oiled	Yes / No
Air valve and motor	Faulty / Normal
Return Air Dampers	
Damper	Binding / Free
Damper oiled	Yes / No
Air valve and motor	Faulty / Normal
"Freon" Cooling Coil	
Strainer	Clogged / OK
Coil casing need paint (yearly)	Yes / No
Coil cleaned (yearly)	Yes / No
Water Coil	
Does it leak?	Yes / No
Coil cleaned (outside)	Yes / No
Dehumidifier – Spray	
Pump and pump strainer	Faulty / Normal
Casing and eliminators (yearly)	Clean / Need Paint
Clean coil (yearly)	Yes / No
Outside Air Intake	
Clean	Yes / No
Leaking rain, snow, birds	Yes / No

Water Cooled Condensers	
Clean (yearly)	Yes / No
Opened and inspected strainer in liquid line (yearly)	
Checked with halide torch	Yes / No
Compressor	
Check high pressure cutoff	lbs
Check low pressure cutoff	lbs
Paint machine (yearly)	Yes / No
Check valve suction and discharge for leak back	
Check head bolts	
Silica Gel	
Condition of gel	
Gel drum bearing	
Gel drum shaft	
Gel drum drive	
Clean steam coil (yearly)	
Clean inside of unit	
Lithium Chloride	
Clean eliminator plates (yearly)	
Activated Alumina	
Check condition of alumina (yearly)	

PROPOSES FIVE YEAR ENGINEERING COURSE

Dean Thorndike Saville of New York University's college of engineering recommended a distinctly new approach to the problem of engineering education in his recent annual report to Chancellor Harry Woodburn Chase.

No college has such a course at the present time. Under the new plan, a general four year course would be established which substantially all engineering students would take. It would be uniform, or nearly so, for the first three years, and would lead to the degree of bachelor of engineering. The first three years would have all of the basic sciences and fundamental engineering subjects now offered, but would add courses in history, public affairs, and economics.

The highly specialized subjects now on the increase in several sophomore and junior year curricula would be omitted. The senior year would have a considerable number of electives, designed on the one hand for those who expect to terminate their technological engineering education in four years, and on the other hand for those who by desire, aptitude, and ability planned or were selected to take a fifth year of specialized programs leading to the designated bachelor's degrees such as A. E., C. E., M. E., and E. E.

Perhaps 50 percent of the total, completing their work for the bachelor of engineering, would be prepared through judicious choice of senior electives to pursue a career as contrasted to strictly professional objectives. They would be better prepared for managerial posts even in industry and government than many present graduates, as they would also be for the types of nonspecialized careers needed for sales, teaching, and foreign service. They could pursue graduate work in many other fields for which their aptitudes and desires had developed.

Other students headed for strictly professional objectives, prepared by senior year electives, would take a fifth year for the designated degrees. They would be as well prepared as now for the first technological positions, and better prepared as professional men and citizens.

A corollary would be the restoration of the master's degree "upon a really post-graduate level." Due to the increase in important engineering and scientific specialties, impossible even to crowd into many of the presently highly specialized undergraduate curricula, the master's degree has increasingly become merely a fifth engineering year in which there is time to pick up specialized courses, desirable for a specialized job. Advanced scholarship and research have declined, in Dean Saville's opinion.

Adoption of the new engineering program will depend on its acceptance by a dozen or more large engineering colleges after industrial and government agencies are convinced that the plan will be beneficial to them in employing future engineering graduates.

Another problem to be overcome involves the resistance of some faculty members to a change in the established policy of adding more and more specialized courses in undergraduate curricula to meet new technological developments.

Dean Saville's report also points out that if the new plan is adopted, students must be given special guidance in order to select those who should pursue general or specialized undergraduate work.

During this inspection, defective parts are repaired and replaced if practicable, but if it is necessary to have the machine down 48 hr, the refrigeration foreman is notified, and together with the air conditioning engineer, if necessary, a program is formulated for repairing or replacing the defective part or parts. This schedule assures us that each piece of equipment in our air conditioning system is being kept in repair, and that each piece of equipment is operating at peak performance. Thus, it is possible for us to approach the cooling season with confidence and as much peace of mind as is possible for operators of air conditioning systems.

Halide Torch Used To Detect Leaks

The inspecting refrigeration mechanic carries a rag with him for cleaning off all equipment. This causes the mechanic to take more pride and interest in his job and enables him to find any leaks which may be detected by the presence of oil on the surface of a machine.

The halide torch is used weekly for the purpose of detecting any "Freon" leaks which may in time dissipate or seriously reduce the refrigerant charge in a system and thus cause the machine to cycle, cutting off on low back pressure.

Water Chiller Tubes Cleaned Yearly

It is also necessary for us to clean the tubes of the water chillers yearly in order to improve the heat transfer and allow us to operate our compressors at the highest back pressure with consequent peak capacity; the condensers must be cleaned so that they may carry away the heat transferred by the compressor at as low a head pressure as possible and with minimum consumption of water.

We have just recently inaugurated the use of these schedules and will alter them as experience dictates. At first glance it might appear that a great amount of time is being spent in inspecting these systems, but we have found that it is good business to locate trouble before it occurs and correct it—rather than to wait until the systems have broken down before parts are ordered and repair work started.

AIR CONDITIONING AIDS FOOD SALES

THE FACT that the C. H. Morgan Grocery Co. is thoroughly sold on year 'round air conditioning for groceries is evidenced by eight years' operating experience together with the recent addition of a third air conditioned store of the supermart type.

The first air conditioning installation in one of the company's Chicago groceries was made in 1939, and because of the gratifying results, Mr. Morgan would rather not open a new store than to begin operations in one that is not air conditioned on opening day.

Newest Grocery Has 15 Hp Compressor

The newest unit in the chain of three stores is located in Evanston, Ill., and occupies a building approximately 50 x 140 ft. The air conditioning equipment, in the basement, consists of air filters, a direct expansion "Freon-12" evaporating coil, a steam heating coil, and a blower, all placed in a cabinet unit. A 15 hp reciprocating compressor is located nearby, as is a cast iron steam boiler, fired by a gas conversion burner.

Outdoor air is taken in through an opening at the rear of the store, and the mixture of return and outdoor air drops into the filter box of the conditioner which is capable of delivering approximately 8000 cfm. Conditioned air is supplied to the store through 16 high wall grilles (eight are located on each side wall). Two high wall return grilles are located at the back of the store, and the summer and winter thermostats are located in the center of the back wall under the returns. Additional supply grilles serve the shipping department in the rear of the store and also serve the lavatories.

One peculiarity of the air conditioning problem in a grocery store is that an inside temperature of about 65 F suffices in winter as shoppers are in street clothes. As a result, it was considered desirable in this installation to maintain warmer temperatures in the office where the bookkeeper and phone operator are located. Supplementary electrical heaters are provided for this purpose.

The amount of outside air being handled by the conditioner may be adjusted by a control (located in the basement) which operates dampers so that adjustments between 100 percent outside air and 100 percent recirculated air may be made. In general, about 25 percent outside air is used except in very cold or hot weather when 10 percent is used.

The C. H. Morgan Co. supermarket, Evanston, Ill., is completely modern. Conditioned air is discharged from 16 high wall grilles located on the side walls. Also shown in this view, taken from the front of the store near the meat department, are the fluorescent lighting fixtures and the perforated acoustical ceiling. (Photograph by E. L. Ray)

This supermarket is modern in every way, incorporating fluorescent lighting and a perforated acoustical ceiling. Canned and packaged foods, fresh vegetables, frozen foods, and meats are handled. In addition to providing comfortable shopping conditions and greater efficiency of store personnel, C. H. Morgan, Jr., states that the elimination of food odors is a major benefit of air conditioning.

Repair and Maintenance Expense Virtually Nonexistent

He also states that the operating cost has never been given much attention. In fact, no real effort to determine the actual operating costs of the company's systems has been made because the obvious advantages and the absence of major repair and maintenance expense have removed any doubts in the management's opinion, as to the necessity for air conditioning.

Filters are cleaned and serviced monthly on a contract basis.

The design and installation of the conditioning system were made by Air Comfort Corp., Chicago.

Safe Mounting, Clearances for Heating Equipment

IT IS READILY understandable that, to prevent fire, open flames and other sources of heat at relatively high temperatures must be kept well removed from combustible materials. However, it may not appear entirely obvious why certain clearances are required, or should be maintained, between combustible materials and heating equipments and portions thereof.

As determined by the National Bureau of Standards in 1937, the normal ignition temperatures of wood of various species, newsprint paper and cotton, range between 514 and 439 F.

Experience indicates that *long continued heating* of wood and other similar combustible materials at temperatures as low as 212 F may produce ignition under favorable circumstances. Therefore, because of the possibility that wood and other combustible materials, after long continued exposure to relatively moderate heat, may ignite at temperatures far below their usual ignition temperatures, and to provide a factor of safety, it is considered good fire protection practice so to install heating equipments that, under *conditions of maximum heat*, the temperature of exposed woodwork will not exceed 160 F. This figure is used in making laboratory tests of heating devices to determine safe clearances and mounting required. Ordinarily it is not feasible to check clearances of installed heating devices by temperature measurements; a simple rule which is sometimes useful is that woodwork is not safe if it is too hot for the bare hand.

Careful investigation should be made as to whether a particular heating device may or may not be mounted directly on a floor or bench of combustible construction; or whether it must definitely be mounted on a base of incombustible construction. Attention should also be given to clearances above heating devices, as well as at the front, sides and rear, and clearances from smoke pipes, range hoods, warm air pipes and registers, and steam and hot water pipes, not overlooking any device or apparatus which may give off heat in sufficient quantity to ignite combustible materials.

It is not sufficient to install heating devices so that during their normal operation adjacent combustible materials will not be exposed to dangerous temperatures; clearances and protection should be designed for safety when the heating device is operated at the maximum temperature of which it is capable. Some provision for ventilating or air circulation or other method of cooling is necessary to dissipate heat. Insulation alone is not sufficient, for no matter how thick the insulation, long continued heat may eventually penetrate it unless the heat is in some manner conducted away before it reaches the combustible material which the insulation is designed to protect.

Devices which are run continuously at a high heat need special attention. In one case reported by the National Board of Fire Underwriters, piles of paper stock on a floor of tile and concrete 12 in. thick were ignited by the heat from high pressure boilers on the floor below, even though the boilers were encased in brick and there was a clear space of 28 in. above them. This fire, as well as others that could be cited, shows the poor insulating qualities of solid masonry and indicates the need of air circulation to prevent the building up of such high temperatures in walls, floors, or ceilings of incombustible construction as will endanger combustible materials in contact with them.

Mention was previously made of mounting of heating devices on floors, benches, etc., of incombustible construction. This term, "incombustible construction," must be defined to include only floors, benches, etc., of fire resistive construction with noncombustible surface finish, as well as fire resistive slabs or arches having *no* combustible material against the underside thereof. Solid masses of brick or concrete may be as bad as no protection at all. Safety lies in entirely noncombustible surroundings, or in so placing and supporting heat producing devices that ample ventilation is secured.

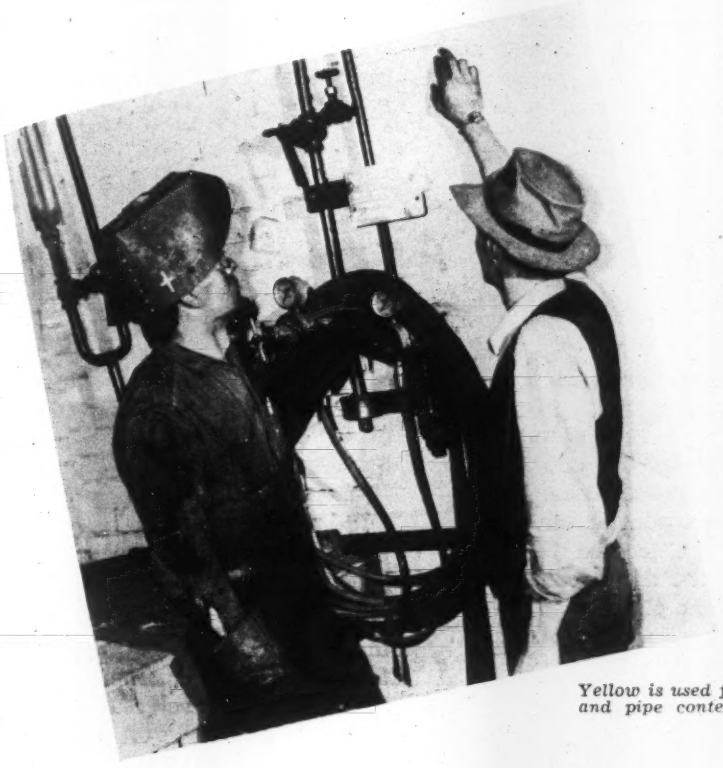
As far as clearances between heating devices and combustible walls are concerned, the reader may think that ordinary plaster on metal lath is sufficient protection for combustible studding in walls or partitions. The fact remains that tests and experience indicate that plaster on metal lath and similar sheathing is of practically no value in this instance. For this reason tables of clearances stipulate that all clearances shall be measured from the outer surface of the appliance to the combustible material, disregarding any intervening protection applied to the combustible material.

When a heating device must be installed somewhat closer to combustible walls and ceilings than recommended practice advises, tested and approved protection may be applied either to the outer surface of the heater or to the exposed combustible surface, thus permitting reduced clearances.

Data concerning the proper mounting and clearances of various types of heating equipments may be had by reference to article XII of the building code recommended by the National Board of Fire Underwriters, 1943 edition. Many modern stoves and heating devices have built-in insulation, which makes it safe to reduce the clearances to combustible material that would otherwise be required; for such devices, previously submitted to a recognized testing laboratory, recommended clearances and mounting may be found in the listings of said laboratories.

Upon closing, it should be clearly understood that fires may not immediately result from improperly mounted and spaced heating devices. Recommended practice is based on *long continued exposure* of combustible materials to unsafe temperatures.—*W. G. Labes, assistant professor, fire protection engineering, Illinois Institute of Technology, in the Bulletin of the Western Society of Engineers.*

Identify Piping for SAFETY



Yellow is used for painting pipe lines to catch the eye, and pipe contents are identified by stencils or tags

A. H. ZEILINGER, safety engineer, Colorado Fuel and Iron Corp., finds that yellow for visibility—with stencils or metal tags identifying the contents—is a practical and effective means for marking industrial piping services to promote safety. A previously-suggested color code, using many different colors depending on the piping service, was rejected as being too complicated. The piping identification program was given considerable impetus one time when workmen hooked up a concrete buster to a 35 lb natural gas line

DYNAMIC COLORING has for its purpose the exact opposite from camouflage. It makes objects stand out to catch the eye, instead of concealing those objects, and it does that by making proper use of colors. Long ago, advertising, traffic, and other fields made good use of dynamic coloring (regardless of the name used) but only in comparatively recent years has industrial safety made use of this agent to any great extent.

Quite recently, qualified engineers by adequate tests came up with the fact that yellow is the best color to catch the human eye quickly. Consequently, we have gone to the use of focal yellow quite widely as an aid in industrial safety. However, I shall confine my subsequent remarks to painting pipe lines to prevent accidents.

This problem has attracted our attention for a number of years, but only recently have we really focused our attention on the subject. In 1936 we were offered the following color code for painting pipe lines:

Acid, sulphuric—orange.
Air—gray.
Benzol—aluminum.
Fuel oil—black.
Gas, coke oven—green, with black for fittings.
Gas, natural—green, with brown for fittings.
Gasoline—bronze.
Lubricating oil—yellow.
Steam, high pressure—buff, with red for fittings.
Steam, exhaust—buff, with black for fittings.
Tar—black.
Water, low pressure—blue, with blue for fittings.
Water, hydraulic—blue, with yellow for fittings.
Water, drinking—blue, with aluminum for fittings.
Water, fire protection—blue, with red for fittings.

One glance at the above list convinced us that it was too complicated for workmen in general, so we discarded the idea of using the above color code.

Concrete Buster Hooked to Gas Line

Sometime later we made another effort to find a satisfactory color plan for our pipe lines. This time our efforts were given a considerable impetus by the fact that some of our workmen had hooked a concrete buster to one of our natural gas lines which carries 35 lb pressure. The error was only a headache, but you can readily see what might have happened had the operation been in a closed place, had the gas been ignited, or had the operator breathed any sizable quantity of it.

At this point in our safety march we painted all our gas lines red. That ended this particular danger, but it did not completely solve our problem.

Next we constructed pipe lines for carrying oxygen and lines for carrying acetylene to our mills. The oxygen lines were painted green, and the acetylene lines were painted red before being put into service.

Our most recent step in safety painting was to indulge in dynamic color painting in general for our mill hazards. The aim here of course is to prevent accidents. As stated above yellow, focal yellow, is the best color to catch the human eye. With the help of the American Standards Association, we have

arrived at the conclusion to paint our pipe lines yellow, and then stencil them with appropriately sized letters to designate the contents. Thus, a line carrying benzol would be painted yellow and the name "Benzol" would be stenciled on the pipe in black letters. If the pipe is too small to be stenciled effectively we use a metal tag with the name of the contents stamped in the metal tag. This is attached to the line near the valve or other place of access.

In the case of long lines or pipes of large diameter, we paint only a few feet of the line near the valve or other point of access and also near where the pipe enters the ground or building. Then, of course, the proper stencil or label is used to identify it.

This painting for safety not only enables the workman to know at all times what is in the line, but also helps in plant housekeeping and builds better safety morale.

If I may offer a slogan it would be: "Paint 'Em Yellow and Save a Fellow."

New York Building Industry Answers Critics

SPEAKING IN BEHALF of the building industry in metropolitan New York, Christian G. Norman, chairman of the board of governors of the Building Trades Employers' Association, asserted last month that reckless and erroneous allegations made against the industry have created confusion in the public mind with the result that our economic well being is threatened and building retarded.

"Building has been made a political football by special interests and it is about time the public's misunderstanding of the problems and achievements of the industry was cleared up so that we can get going on a high level of essential construction needed," he said.

Discussing building costs in New York, Mr. Norman said that, contrary to general belief, they were not out of line with the rest of the country, and in many instances had risen less than in other major cities. He pointed out that in 1920, in the inflation that followed World War I, construction costs nationally reached a peak of 172 percent above the then prewar year of 1915. The postwar purchasing power of the 1915 building dollar in 1920 was 36 cents. In 1947, the 1941 building dollar is worth 49 cents, according to the Dow Service, and costs are 104 percent higher on the average than they were in 1941.

Quoting from a recent survey of 14 cities made by the Dow Service, he said that average construction costs in New York City have increased less than in Chicago, Boston, Philadelphia, Cincinnati, San Francisco, Los Angeles, New Orleans, and Miami. Since 1941, according to the survey, construction costs in New York have risen 92 percent, compared with 95 percent in Chicago, 101 in Boston, 131 in Philadelphia, 122 in Los Angeles, and 124 in San Francisco.

Mr. Norman pointed out that in New York are located the headquarters of the major construction companies who planned and directed the "miracles of construction" during the war. It is the same industry, he said, which is today being subjected to "unfair criticism and reckless charges of monopoly and restrictive practices" by misinformed critics and special pleaders.

In defense of the industry, he recalled a recent comment by Thomas S. Holden, president of the F. W. Dodge Corp., and a recognized authority on building. He quoted Mr. Holden as saying:

"Unfortunately, the great performance of the American construction industry, in war and peace, is not half appreciated by the American people. This people, with its love for shortcuts, has grown into easy acceptance of slogans in lieu of truth; and one of the most frequently repeated slogans is the one about the supposed backwardness of the construction industry. So often has this silly statement been reiterated that the idea of backwardness has become fixed in the public mind; even some people in the industry have begun to believe it.

"Show me another country which, during the war, developed revolutionary new techniques of factory design and layout. Show me another country where the family of average income is better housed, in better neighborhoods and with more comforts and conveniences, than in the United States. Show me another country where an Empire State building can be completed in 18 months.

"But, say the critics, look at the automobile industry. Well, let's look at it.

"It is one of America's modern industrial miracles . . . but I maintain there is no common yardstick by which these two great industries can be compared in order to evaluate their relative efficiency. Both industries are currently facing a common problem, the problem of catching up with a backlog of accumulated demand in a period of shortages and price inflation.

"This year, second full year after cessation of hostilities, housing completions will reach an estimated 85 to 90 percent of previous peak production; passenger automobile production will be 75 to 80 percent of its previous peak. The wouldbe car purchaser is currently promised delivery in eight to 14 months. Many prospective purchasers of houses are also having to wait. Purchasers of used houses have been paying scarcity prices, just as purchasers of used cars have been doing. Purchasers of new houses have had to pay premium prices, not charged in any dealer's markup but in the scores of excess cost items that the builder has had to pay in the shortage market.

"If the American people can be persuaded to appraise the construction industry by the best of its accomplishments, and by the high competence of its average accomplishment, they will learn to be proud of it."

BOILER EFFICIENCIES WHEN USING GAS

By C. George Segeler, Engineer of Utilization, American Gas Association

Boiler Efficiencies for Carburetted Water Gas

534 Btu per cu ft
17.14 percent ultimate CO_2

Percent CO_2	Percent excess air	Flue gas temperature, F				
		300	400	500	600	700
9	90	78.5	75.5	72.0	69.0	65.0
10	70	79.5	76.5	73.0	70.0	66.5
11	54	80.0	77.5	74.5	71.0	68.5
12	42	81.0	78.5	75.5	72.5	70.0
13	31	81.5	79.5	76.0	73.5	71.0
14	22	82.0	80.0	77.0	74.5	72.0

Boiler Efficiencies for Mixed Coke Oven and Carburetted Water Gas

545 Btu per cu ft
13.9 percent ultimate CO_2

Percent CO_2	Percent excess air	Flue gas temperature, F				
		300	400	500	600	700
7	93	78.5	75.5	71.5	68.0	64.5
8	70	79.0	76.0	72.5	69.0	66.0
9	50	79.2	76.5	73.5	70.5	67.5
10	37	79.5	77.0	74.5	71.5	69.0
11	25	80.0	77.5	75.0	72.5	70.0
12	16	80.5	78.0	76.0	73.0	71.0

Boiler Efficiencies for Natural Gas

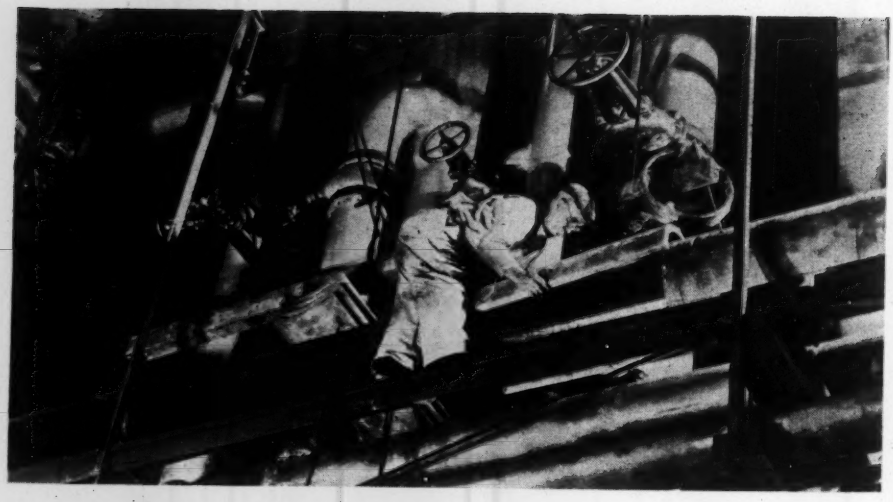
1000 Btu per cu ft
11.79 percent ultimate CO_2

Percent CO_2	Percent excess air	Flue gas temperature, F				
		300	400	500	600	700
6	100	77.0	73.0	69.0	66.0	62.0
7	67	78.0	74.0	71.0	68.0	64.5
8	48	78.5	75.0	73.0	70.0	67.0
9	32	79.0	76.0	74.0	71.0	68.5
10	20	79.5	77.0	75.0	72.0	70.0

NOTES

The efficiencies shown in the above tables include "moisture loss" and also a 5 percent "radiation and unaccounted for loss."

The tables deal only with combustion efficiency; the user, in the final analysis, is interested in overall seasonal efficiency, which includes other factors—although the control of CO_2 in the flue gases is of primary importance. It is not felt, on the other hand, that it is right to extend the data to the ultimate CO_2 percentage, since at least 20 percent excess air must be allowed in the flue gases as a margin of safety. The tabulated data have therefore been cut off at about this point.



How to Figure Weight of PIPE INSULATION

PROCESS, PIPING, and power design engineers are often confronted with the many tiresome calculations involved in obtaining the weight of pipe covered with the accepted insulation materials for various temperature conditions. This information—whether required for purchase requisitions, design of pipe hangers, estimation of floor loads, or whatever other purpose—cannot be easily found in the usual literature.

The authors, in an attempt to reduce the time and labor required to calculate the weights of high temperature and/or 85 percent magnesia thermal insulation for any IPS pipe at any of the customary insulation thicknesses, have compiled the accompanying tables.

Two examples will illustrate the ease of use and the saving of time effected.

Example 1—Find the weight per foot of standard thickness insulation on a 6 in. IPS pipe for normal operation at 500 F.

From the large table, it appears that for temperatures under 600 F a single layer of 85 percent magnesia is indicated, and for a 6 in. nominal size pipe the standard thickness insulation covering weighs 3.12 pounds per linear foot.

Example 2—Find the weight per foot of the total insulation on a 12 in. IPS pipe for service at 850 F.

It is necessary to know the thicknesses of the low temperature and of the high temperature insulation layers. Let us assume that we are given a standard thickness for the first or high temperature layer next to the pipe, and a double standard thickness for the second or magnesia layer.

From the large table we see that the weight of standard thickness high temperature insulation on a 12 in. pipe is 11.8 pounds per foot. From the supplemental small table we find the standard thickness of insulation for a 12 in. IPS pipe to be 1½ in. (double standard would be 3 in.).

Supplemental Table of Standard Thickness Dimensions

Up to and including	1½	in. nominal pipe size:	⅞	in. thick
Up to and including	3½	in. nominal pipe size:	1 1/32	in. thick
Up to and including	6	in. nominal pipe size:	1⅛	in. thick
Up to and including	10	in. nominal pipe size:	1¼	in. thick
Over	10	in. nominal pipe size:	1½	in. thick

We now consider a theoretical pipe with an outside dimension of 12 + 1½ + 1½ or a 15 in. diameter. The weight of this second layer, from the large table, is found to be 18.9 pounds per foot. The sum total is therefore 11.8 + 18.9 or 30.7 pounds of combined insulation per linear foot for the 12 in. IPS pipe.

It will be seen, upon inspection, that these tables are also helpful in determining the spacing of pipe hangers, pipe clearances, etc., and should become a welcome and oft-used addition to the files of interested engineering personnel. The authors hope this information will be as valuable to other engineers in their piping work as it has been to them.

S. S. ULRICH and T. H. DICKSON, JR., of the Cunningham-Rudy Co., and the Wyandotte Chemicals Corp., respectively, **present here tables that simplify determination of the weight per linear foot of pipe of high temperature and/or 85 percent magnesia insulation. This information—whether for purchase requisitions, pipe hanger design, estimation of floor loads, or other purposes—is not easily available elsewhere.**

Weight of Pipe Covering in Pounds per Linear Foot

85% Magnesia (16 lb per cu ft average) suitable for temperature up to 600 F
High Temperature (25 lb per cu ft average) suitable for temperature over 600 F

Thickness of Covering	Nominal Pipe Size, Inches											
	¼	¾	1	1¼	1½	2	2½	3	3½	4	4½	5
Standard Thickness	0.54	0.62	0.69	0.80	0.86	1.25	1.43	1.66	1.84	2.23	2.43	2.65
	0.84	0.97	1.08	1.25	1.34	1.95	2.23	2.59	2.88	3.48	3.80	4.14
1½"	1.24	1.37	1.50	1.70	1.80	2.06	2.32	2.65	2.91	3.17	3.52	3.73
	1.94	2.14	2.34	2.66	2.81	3.22	3.63	4.14	4.55	4.95	5.50	5.83
Double Standard Thickness	1.85	2.02	2.18	2.43	2.56	3.24	3.83	4.30	4.68	5.35	5.73	6.19
	2.89	3.16	3.41	3.80	4.00	5.06	5.98	6.72	7.31	8.35	8.95	9.67
2"	2.00	2.18	2.36	2.62	2.75	3.10	3.23	3.88	4.23	4.58	4.93	5.32
	3.13	3.41	3.69	4.10	4.30	4.85	5.05	6.06	6.62	7.16	7.71	8.31
2½"	2.95	3.16	3.38	3.71	3.87	4.31	4.75	5.29	5.73	6.17	6.60	7.10
	4.61	4.94	5.28	5.79	6.05	6.73	7.42	8.27	8.95	9.64	10.3	11.9
3"	4.06	4.32	4.58	4.64	5.17	5.70	6.22	6.87	7.40	7.92	8.44	9.03
	6.35	6.75	7.16	7.25	8.08	8.91	9.72	10.6	11.6	12.4	13.2	14.1

	6	7	8	9	10	11	12	14	15	16	17	18
Standard Thickness	3.12	3.93	4.40	4.83	5.29	6.94	7.53	8.12	8.64	9.16	9.69	10.2
	4.88	6.14	6.88	7.55	8.26	10.8	11.8	12.7	13.5	14.3	15.1	15.9
1½"	4.32	4.84	5.37	5.96	6.48	7.00	7.53	8.12	8.64	9.16	9.69	10.2
	6.75	7.56	8.39	9.31	10.1	10.9	11.8	12.7	13.5	14.3	15.1	15.9
Double Standard Thickness	7.07	8.95	9.82	10.8	11.7	15.6	16.6	17.8	18.9	19.9	20.9	22.0
	11.0	14.0	15.3	16.9	18.3	24.4	25.9	27.8	29.5	31.1	32.6	34.4
2"	6.11	6.81	7.51	8.29	8.99	9.69	10.4	11.2	11.9	12.6	13.3	14.0
	9.55	10.7	11.7	12.9	14.0	15.2	16.3	17.3	18.6	19.7	20.8	21.9
2½"	8.07	8.95	9.82	10.8	11.7	12.5	13.4	14.4	15.3	16.1	17.0	18.0
	12.6	14.0	15.3	16.9	18.3	19.5	20.9	22.5	23.9	25.1	26.6	28.1
3"	10.2	11.3	12.3	13.5	14.5	15.6	16.6	17.8	18.9	19.9	20.9	22.0
	16.0	17.7	19.2	21.1	22.7	24.4	25.9	27.8	29.5	31.1	32.6	34.4

	19	20	21	22	23	24	26	27	28	30	32	33
Standard Thickness	10.7	11.3	11.8	12.2	12.8	13.3	14.4	14.9	15.4	16.5	17.5	18.0
	16.7	17.5	18.4	19.1	20.0	20.8	22.5	23.3	24.1	25.8	27.3	28.1
1½"	10.7	11.3	11.8	12.2	12.8	13.3	14.4	14.9	15.4	16.5	17.5	18.0
	16.7	17.5	18.4	19.1	20.0	20.8	22.5	23.3	24.1	25.8	27.3	28.1
Double Standard Thickness	23.0	24.0	25.1	26.2	27.2	28.3	30.4	31.4	32.5	34.5	36.7	37.7
	35.9	37.5	39.2	40.9	42.5	44.2	47.5	49.1	50.8	53.9	57.3	59.0
2"	14.7	15.4	16.1	16.8	17.5	18.2	19.6	20.3	20.9	22.3	23.9	24.4
	23.0	24.1	25.1	26.4	27.4	28.3	30.6	31.7	32.6	35.2	37.4	38.2
2½"	18.8	19.6	20.5	21.4	22.3	23.1	24.9	25.7	26.6	28.4	29.6	31.0
	29.4	30.6	32.0	33.4	34.8	36.1	38.9	40.1	41.6	44.4	46.3	48.4
3"	23.0	24.0	25.1	26.2	27.2	28.3	30.4	31.4	32.5	34.5	36.7	37.7
	35.9	37.5	39.2	40.9	42.5	44.2	47.5	49.1	50.8	53.9	57.3	59.0

NOTE: For each thickness of covering—
Upper line of figures is for 85% magnesia covering
Lower line of figures is for high temperature covering

S.S. ULRICH
T.H. DICKSON JR.

Design Engineer Reports on Operating Experience with Pumps, Valves, Compression Tanks

PRACTICAL PIPING PROBLEMS

JOHN H. CLARKE was after information on the problems with piping systems, pumps, valves, heaters, control and other mechanical equipment faced by the operating man . . . how designs perform in actual service . . . how equipment is actually operated . . . when he (a marine design engineer by training and profession) shipped on a tanker as junior third assistant engineer. By the time his seagoing was completed (he's back on land as a design engineer with the Standard Oil Company of Indiana) he got plenty of practical information on piping, pumping, heating, ventilating, and other subjects. His comments and observations are continued here from our January issue. Much of what he found out applies not only to marine work but to the design, operation, and maintenance of mechanical equipment in plants and buildings

WE FINALLY managed to get all our crew members aboard, and started from the dock about 10 a.m. Having been on duty all the previous night, the morning watch and maneuvering were "observed from the sack." We left Sydney in reasonably nice weather but soon ran into squalls outside the port. We were carrying very little ballast and this made the riding rough; so rough, in fact, that it was necessary in a matter of hours to slow down and take on ballast. Such severe pitching is very hard on the machinery and with proper ballasting it can be kept to a reasonable minimum.

During the most severe pitching, our main turbine governor was varying the steam chest pressure from about 250 psi to full (about 425 psi). While the rpm's of the turbogenerator and the synchronous propulsion motor were held to a remarkably low variation, it can be appreciated that the variation in torque must have been tremendous, as the propeller alternately dug down into the water and then came nearly halfway out of it. The whole ship shook severely from the vibration. The wide changes in steam chest pressure at the turbine were reflected in rapidly fluctuating changes in the boiler level, caused by the swelling and collapsing of the water volume. This resulted in continual movement of the feed regulators and the feed pump governor, and a continual change of speed on the feed pumps. Other equipment was affected in the same manner. This is one of the design problems of the marine engineer.

We hadn't been out of Sydney more than a day or two when the salt water sanitary (flushing) line to the midship house failed. This was another one of the many lines attached to or carried on the underside of the catwalk structure. The catwalk itself had torn loose from the midship house twice and had had to be rewelded.

Pipe Straps "Freeze" to Pipes

This trouble, and the failure of several of the deck mains, were caused by the "freezing" of the pipe straps to the pipes, thus preventing them from moving at the supports. Contributory causes to the failure of the sanitary main were a poorly and improperly brazed joint, and an improper design of flanged joint. The pipe was of copper and the joint in question had one steel flange and one brass flange (companion flanges). The break was at the steel flange, which should never have been used in any case for salt water service in a copper line. Marine rules call for a lapped joint for such flanged connections, and in addition it was usually required to back-braze the hub to the tubing. In this case, the tubing was just barely flared at the face of the flange, and the hub braze showed no evidence of proper adhesion to the hub of the flange. The braze broke cleanly at the boundary of the steel hub and the brazing metal, and the tubing pulled back from the flange on one side.

We had no brazing equipment on board, so a temporary repair was made by means of a section of $2\frac{1}{2}$ in. fire hose clamped to the 2 in. sanitary main. It leaked a bit but seemed to do its job.

About the third day out of Sydney, our forward bilge pump

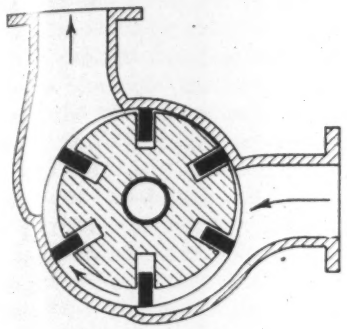


Fig. 1—Vane type rotary bilge pump used on the author's ship, showing flow, rotation, and location of the rotor vanes

jammed and wouldn't start. These were vane type rotary pumps, Fig. 1, and had been sounding like cement mixers long before the failure took place.

Pump Jams, Won't Start

The pumps had phenolic resin vanes with brass backing strips, and brass casing liners. When the pump was opened up, it was found that one of the vanes had slipped part way out of its slot and had cocked and jammed, as shown in Fig. 2. This prevented the pump from starting. As will be noted from Figs. 2 and 3, there had been considerable wear of the vanes to the point where a sweeping motion, instead of a completely radial motion, was taking place as the vane moved in and out in its slot. The phenolic resin wore away on the leading edge until it was fully rounded. In addition, bits of metal and grit had become embedded in the softer phenolic resin and had acted as a cutting tool with respect to the wear of the casing liner, and had prevented the wear at that point of the vane itself. This caused the extremely ragged wear of both the casing liner and the vanes. Note in Fig. 3 how deep this wear and grooving were on this pump.

From observation, and numerous talks with other engineers and representatives of the pump manufacturer, there seemed to be a number of factors contributing to the failure of the pump. To begin with, the oilers who usually pumped the bilges seldom primed the aft pump. The forward pump had a priming line, but this had been disconnected during some previous repairs on the ship and had been left disconnected. Whether or not this was intentional is not known, but there is no doubt that the lack of priming water hastened the wear on the pump. The bilge suction pipes were fairly long in some cases and because of leaks in the various manifolds and valves, it was necessary to run the pump for some time before evacuation of the air was accomplished. The oilers didn't bother to check the pumps much, and frequently let them run by the hour, long after the suctions had pulled out. This was certainly hard on the pumps.

The bilge water, of course, carried a considerable amount of grit, welding beads, metallic particles, and other abrasives. Consequently it should have been expected that a certain amount of this material

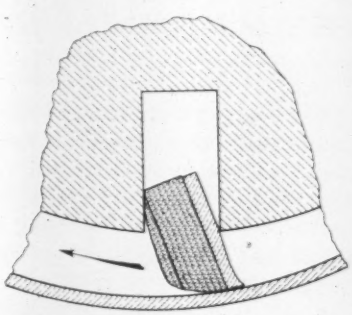


Fig. 2—This sketch shows how the vanes indicated in Fig. 1 turned in their slots, and how one of them finally jammed

would become embedded in the vanes. It would seem (as was believed by a number of engineers) that the vanes for this service should have been all brass, wearing on a harder brass casing liner. In addition, the vanes on these pumps had a total clearance in the slots of nearly 1/16 in.; whether or not this approximated the original clearance is not known, as there was probably some wear. But in any case, it must have been excessive and probably started the rounding of the leading edges of the vanes.

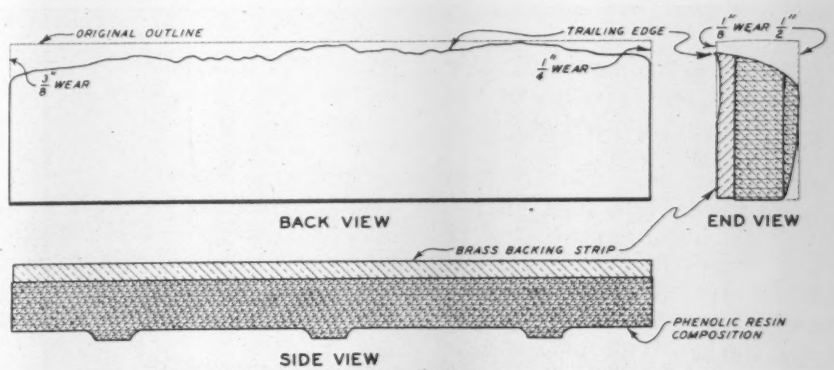
It is my opinion that this type of pump should have been designed so that the vanes could only move so far, radially; with a stop provided, it would not have been possible for one of the vanes to jam. Thus, while the vanes would wear to the point where they would not maintain suction, at least no damage would result, and the worn blades could be easily replaced. It should be added that we had this same type of pump for the cargo oil stripping pumps, and in that service they seemed to perform very well. At least we had no trouble.

Hose Breaks Up a Party

As usual, we had our share of funny incidents during the trip from Sydney to Balboa. One day the deck crew called down for us to start a fire pump so that they could hose down the aft deck. For various reasons we were unable to comply with their request for about half an hour; by that time, the deck squad was busily engaged in a "bull" session, with one of the boys hanging on to the hose nozzle for lack of anything better to do.

Usually when we started up a fire pump for deck washing we opened an overboard valve so as to hold the pressure down to a reasonable figure, but this time, when the oiler started the pump, someone had closed one of the three valves in the overboard line and he did not notice this. The pump took hold with a bang and they got the works on deck—about 160 psi worth. According to reports, the party on deck broke up immediately. The

Fig. 3—Wear of the vanes shown in Figs. 1 and 2 is indicated in this sketch, which was traced directly from one of the pump vanes. The humps and grooves had their counterparts in the worn casing liner



unlucky fellow hanging onto the nozzle, who—up to *that* time—had been a friend of the oiler, sailed clear across the aft deck on his nether end, and brought up with a bang against the rail.

In the meantime, the hose itself was going through the usual snake dance of a hose under pressure, and the nozzle was practically pounded out of shape and was a loss as far as future use was concerned. Fortunately, no one was hurt and the situation was immediately brought under control, but there was a distinct air of restraint in the crew's mess between the deck and the engine boys for a few days after the accident.

We had taken on a new first assistant engineer at Sydney to replace the one who left the ship. He had previously been on a tanker, but had never sailed on a turbo-electric ship, so he had quite a task learning the controls, the switchboard, and the operation of the plant. In sharp contrast to others of the force, he learned rapidly—principally because he *wanted* to, and didn't mind asking for help. In addition he was a hard working and capable engineer and repairman. Considering that he got little cooperation from most of the crew, he did a remarkable job, and soon had the engine room and equipment in gleaming paint and the best possible running order with the means available.

This proved to me that most of our operating problems were brought about by a lack of desire to learn the proper operation of the equipment, and lack of proper supervision in keeping the maintenance and repairs above the minimum necessary to just reach the next port. With *this* first assistant and a chief engineer who paid more attention to what was going on in the engine room, our entire trip would have been quite different.

A few days out from Sydney, the chief took the first assistant below to show him the operation of the feed pumps and the feed piping in that area. At this time, they changed over from the aft feed pump to the forward feed pump—the one which had been repaired at Sydney. Following this, it was noticed that we were getting excessive steam leakage from the shaft glands on the turbine. This seemed odd, but queerer things had happened many times before on this ship.

It was not until about a week or so later that we discovered the cause of the leakage. We had to change over feed pumps for a short while in order to replace a leaking plug in the feed pump casing. In so doing, it was discovered that the turbine exhaust valve had never been opened. These valves were of the spring loaded, swing gate type designed to act as relief valves. Evidently this had increased the back pressure on the turbine enough to cause the gland leakage without making it apparent that something was wrong. The oversight was corrected during the above change-over, and we rolled merrily on our way.

Defective Valve Stops the Ship

That is, we did for awhile. It was shortly after this that we had an emergency stop because of a defective gate valve; this little incident brought to mind a number of design items that the engineer should keep in mind. The valve in question was on the outlet to the main generator air cooler. The generator air temperature was controlled by hand by means of the above-mentioned 3½ in. gate valve.

Ordinarily, I would prefer a globe valve for this service and would have preferred to control on the inlet side. But the generator manufacturer made this impossible by providing the water inlet at the *top* of the cooler (the cooler tubes were horizontal, and the whole cooler was in the horizontal plane) and the outlet at the *bottom*. This made it extremely difficult to purge the unit of air, to keep the tubes full of water, and to maintain close control of the temperature. This meant that the gate valve was frequently being adjusted to keep the generator air at the desired temperature. To make matters worse, the valve was of the double disc type, made of cast iron, with brass inserts in the discs. All of the adjacent piping was of copper. The cooling water, of course, was sea water.

On the evening in question, my oiler noticed that the generator temperature was higher than usual. The circulating valve was opened but nothing happened. We then closed down on the valve and opened up the cooler air vent to see if we could force out the air and fill the cooler with water. This didn't seem to work either, so the valve was again opened—so we thought. The generator air temperature now began to climb steadily and it became apparent that we had dropped the discs from the valve stem. There was nothing to do but call for help, notify the bridge, and stop the ship for repairs.

But it wasn't as simple as we thought it would be. We couldn't close the root valve at the circulating main more than a turn because it was apparently in a badly corroded condition and we were afraid it might also jam closed, so we had to make our repairs with the circulating pressure on the line. All electrical equipment that might be damaged was covered with canvas to protect it from splashing water.

Getting the bonnet off was quite a task because the enterprising manufacturer had tried to shorten the valve to the minimum, and in so doing had not provided proper clearance for the bonnet flange and the pipe flange bolts, with the result that they interfered with each other and could not be properly turned with any kind of wrench. Most of our 40 min delay was caused by this difficulty in removing and replacing the bonnet bolts. The valve discs were removed from the valve and we were able to get underway again as soon as we had replaced the bonnet. The valve discs were in an advanced state of corrosion and erosion and could hardly be recognized. It was no wonder that they had dropped off the stem and jammed in the body.

Other Trouble with Valve Bolting

This was not the only case where we had trouble with valve bolting. At the port generator governor valve assembly, we had a similar situation. In this case, the stop valve body was of such a shape as to make it impossible to get the bolts in except from the pipe flange side. The nut or head clearance was so small that nothing but an open end wrench could be used for tightening. The bolt nuts in this case were on the valve end, but it was only possible to tighten the bolt at the head (pipe flange) end, so we were never able to tighten the joint properly. The bulkhead

adjacent to the assembly was quite close, and a hanger clip interfered just enough to make it utterly impossible to get at the back flange bolts. For the above reasons, this joint leaked with increasing severity for practically the entire six months that the ship was out. Under the circumstances, there was nothing we could do about it without a major shutdown, and a reassembly of the governor valve assembly piping.

It would seem that valve manufacturers generally could afford to pay more attention to proper bolt clearances. It should not be necessary, as it frequently is nowadays, to remove a complete valve assembly just to repair one valve—all because it is impossible to get the bolts out and back in on the valve requiring the repairs. All of us prefer to keep valve sizes to the minimum, but there is certainly a practical limit to this. I would be much interested in learning of the reaction of other engineers concerning this problem.

We had another piping failure caused by poor installation of the piping. This occurred in the salt water circulating line that provided cooling water to the feed pump bearings and the refrigeration condenser, and also provided the sanitary flushing water. In this case, the pipe corroded out at a threaded joint between a steel nipple and the adjoining brass fitting. This complete system was of brass except for this nipple, so it was no wonder that the joint did not last for this service. We couldn't stop the feed pump for this repair, so the first assistant did a clever job of using a temporary hose jumper while a new nipple was being provided in the line.

For the rest of this 24 day jaunt, we had fairly clear sailing and reasonably good weather. We again passed close to Pitcairn Island and our radio operator had quite an animated conversation with the island operator. "Sparks" had stopped to visit the latter's mother when we were at Wellington, N. Z., and that gave them quite a topic for conversation.

Valve Wrenches—Use or Not Use?

The first assistant used this good sailing to advantage in cleaning up and painting the main turbogenerator room and its decking and generally straightening up all over. It began to take on some semblance of a wellkept and maintained ship.

In the process of this housecleaning, we missed several of our pet valve wrenches. We had some really obstinate valves on this ship, and while I ordinarily don't take much stock in valve wrenches, they are much better than using Stillson wrenches for this purpose. But it seems that the new first assistant didn't like them for any valve, and had started his campaign against them by tossing our pet 18 and 24 in. shillelaghs overboard. This left us with some measly 12 in. ones that we used on the sticky bilge manifold valves and some other small but recalcitrant handwheels.

A lively argument ensued, with the first assistant insisting that the valves should seat tight and therefore didn't require wrenches because there would be no need to tighten down or jam open a valve. He was right about the latter, but occasionally a valve handwheel did get stuck open, and it didn't help to know that it shouldn't have done this. As for sticking shut—that was a different story. None of the bilge manifold valves could be shut anywhere near tight without a valve wrench, and if not tightly closed, it was very hard to pull a suction with the bilge pumps. The bilge manifold valves had what I would call sharp seats—even though the corners were relieved with a 1/16 in. wide bevel. It is my contention that a fully bevelled seat, for *this* service at least, would have stayed tighter than the sharp seat. In design work, the organizations with whom I had worked had always insisted on fully bevelled seats (and discs) for such manifolds.

We won the first assistant over to our point of view on this case, but the clinchers were the 2½ in. series 60 cast steel auxiliary turbine stop valves, and the 4 in. series 60 cast steel stop valve on the line to the external desuperheater. None of these valves could be closed without a valve wrench. The external desuperheater valve could not be closed *with* one; it was only possible to minimize the leakage. We had gages on these lines and the first assistant was going to show us how to shut them off without the wrenches. He never succeeded, and it was to his credit that he cheerfully admitted his error.

None of the above should be construed as advocating valve wrenches. They have their uses in some cases, where employed intelligently, but there is no easier way to abuse, warp, or break a valve. I will never forget the day I opened the above mentioned external desuperheater valve with a valve wrench and found that it was necessary to force the handwheel for nearly a full turn before it broke free. Someone had really jammed that valve *shut*.

An aerial view of the Sydney harbor entrance

How to Pipe a Compression Tank

Being quite familiar with the piping on these ships, I had on several occasions reviewed various parts of the ship's piping systems with the first engineer in order to help him to become better acquainted with them. On one occasion, we went up midships to see why we were having trouble with the drinking water system. Most of the time the midship drinking water had been supplied from the aft pump in the engine room, and we usually used the midship pump to transfer water from the midship tanks to aft. The aft pump ran continuously, with a back pressure regulating valve to handle load changes. The forward pump ran in conjunction with a pressure switch and a pneumatic (compression) tank. Recently, this tank had been provided with air so that the pump would operate properly.

Apparently that was when the trouble started, and when we finally checked into the piping, we soon found the source of the trouble. The piping wasn't *designed* the way *we* found it, so some enterprising pipefitter or operating engineer must have rigged this one up on his own. In this case, the discharge pipe from the pump went into the bottom of the compression tank, and then the supply connection was taken off the side of the tank as shown in Fig. 4b. Consequently, when the air bubble got down to that point, we didn't get much water from the system, and at the same time air was lost from the tank.

The compression tank should have been on a dead end branch of the discharge line as shown in Fig. 4a. This is the correct way to pipe a compression tank and is the usual practice both at sea and ashore.

I recently came across a design by a wellknown architectural office wherein the discharge was taken off the bottom of the tank, as in Fig. 4c, and because trouble had been experienced in maintaining the air bubble in similar tanks at the right level, a system of air controls was provided to keep the bubble at the right level. Ordinarily no such trouble is encountered with the dead end connection because air is not liberated or absorbed to any large extent in the slow movement of the water into and out of the tank. This is *not* the case where the supply water passes through the tank, as in Fig. 4c.

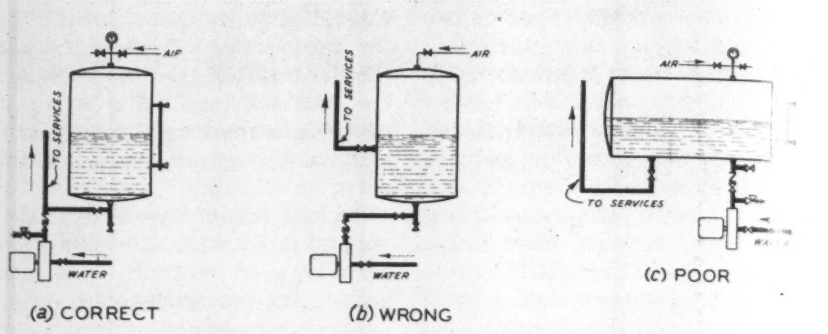


Fig. 4—Piping connections for a drinking water pressure system incorporating a compression (pneumatic) tank. Sketch (a) illustrates the correct piping connections for this sort of tank. Note that the tank is on a "dead end" branch off the pump discharge. Sketch (b) shows how the piping on the author's ship tank was connected. With the discharge piping taken off the side of the tank, it was impossible for the system to work properly. Sketch (c) indicates another type of tank connection that the author recently came across. Such a connection is not recommended because the constant flow of water through the tank will cause it to either liberate or absorb air in the tank, thus making it necessary to restore the operating level frequently

We made no attempt to change the tank connections at this time. It hardly seemed necessary as long as drinking water could be gotten from the aft system, and there were other more important tasks to be accomplished. One of the most disagreeable of these was to clean out the refrigerator in the officers' mess room. This was a small refrigerator (about 6 cu ft) of the household type, made by one of the better known manufacturers. It was nothing to boast about.

Word of Warning About Refrigerators

It had been my understanding that all reputable manufacturers were careful to seal the closing pieces for the insulation on the cabinet at the door. The four closing strips around the door frame on this refrigerator were of plastic about 1/16 in. or slightly more in thickness, and were fastened by screws at the corners only. Of course they were not moisture-tight—or liquid-tight, for that matter. Over many months, milk and fruit juices had spilled in the refrigerator and run over the lip at the front of the box, and then seeped under the bottom closing strip and into the insulation. This seepage had taken on an odor that was almost intolerably nauseating. We removed the bottom strip, took out the soaked glass wool insulation, and removed almost a quart of foul smelling liquid—really foul.

It was learned that about a year previous to this the electrician had been required to make a similar repair on the crew's mess refrigerator, the problem being complicated by the fact that the wiring insulation on the refrigerator box light wiring, which came up through the bottom of the cabinet through the insulation, had rotted off and caused a short which blew the fuse.

It is hard to believe that household refrigerators could still be made this way and still be sold to the public. But this *is* the case, if late models on display by this same manufacturer are any criterion. It would pay any prospective buyer to check carefully the wiring and the type of closing provided for the insulation of the household refrigerators offered for his purchase. Where such closing strips are not sealed moisture-tight, buy elsewhere and save yourself a lot of disagreeable trouble.

Better Ventilation Needed

Surprisingly enough, it was comparatively cool sailing on this leg of our voyage even after we had crossed the equator and up until we were about two days out of Panama. Then it turned suffocatingly hot. This was the first hot spell we had had since leaving Abadan, Iran, when following winds had reduced the effectiveness of the cowl ventilators to almost nil. For two straight weeks on that trip, the engine room operating station temperatures had never gotten below 98 F and were usually above 100.

Now, while coming into Panama, a good opportunity presented itself to collect some data on the subject. The outside air temperatures at the equator were 84 F. At Balboa, Canal Zone, the air temperatures were 93, 94, and in that vicinity. Our cabin temperature never got below 98. Two tabulations of engine room temperatures, taken before the hottest weather, with a following wind, are as shown:

Outside air temperature	78	82
Sea temperature	83	84
Boiler room operating level		120
Boiler room operating level at combustion control board	122	125
Boiler room under vent		96
Boiler room middle grating	139	140
Boiler room upper grating		144
Boiler room at forced draft fans	142	150
Main turbogenerator room		116
Main turbogenerator room at control station	99	96
Main turbogenerator room under vent		90
Lower engine room	103	99
Shaft alley	100	105

Needless to say, such temperatures do not provide efficient conditions for the machinery operation, maintenance, or personnel. Among other things, these ships had considerable trouble with the bearings of the forced draft fan motors. This difficulty was finally solved by the use of special high temperature lubricants. Trouble was also encountered with hardening and cracking of the electric cable insulation.

The above table is an excellent illustration of the need for *mechanical* ventilation *throughout* these spaces, properly proportioned (with an excess of exhaust to keep the heat from the living spaces) to do the job. However, the use of cowl ventilators with the ventilating fans is something more than a farce, because a cowl trimmed away from the wind will materially decrease the available ventilation—and you can't spend all of your time trimming cowls. In stormy weather cowls are useless.

Well, why were these ships provided with cowl ventilators, some of which *did* have fans operating in conjunction with them? If such a question were asked of the average operating engineer on a ship he would blame the design engineer. But these ships were a good example of the fact that one of the greatest enemies of the marine operating engineer *is the marine operating engineer ashore—the port engineer*. The latter operate on the theory that what was good enough for them when they were at sea is good enough for their successors. They forget about their long hours of sweating and cussing over the improvements *they* thought should be provided.

In the early stages of the design of these ships, the port engineers for the operators had ample opportunity to recommend a lot of improvements, including the ventilation systems. As far as could be learned, they felt that the ships were highly satisfactory, despite operating reports to the contrary. There were many design changes ultimately made at the insistence of the various operators, but there were no significant changes made to the ventilation systems except to provide mechanical ventilation throughout the main turbogenerator room, still adhering, of course, to the same cowl ventilator inlets. But for the hottest space on the ships, the boiler room, no mechanical ventilation was ever provided. This, as far as I am concerned, defies all logic.

DIESEL ELECTRIC SET COMES TO RESCUE

THE PARALYZING sleet and snowstorm, which struck the midwest as 1948 rolled into being, dealt a particularly crippling blow to power and communication lines in central Illinois and the first week of the new year found the more than 200,000 residents of the greater Peoria area busy fighting persistent threats to health and to the normal conduct of business.

The trouble started with a rainstorm and dropping temperatures on New Year's eve, with the rain turning to sleet by midnight and then to snow.

By mid-day of New Year's, pockets of isolation—so far as communications were concerned—had sprung up throughout the area and thousands of persons were suffering from electric power interruptions and complete breakdowns. Facilities dependent upon electric power—lights, refrigeration, heating, and sundry others—were inoperable in more than half the homes and business establishments of the area.

Loveridge Florist Co., Peoria, for example, with greenhouses covering an expanse of 65,000 sq ft, faced a possible loss of $50,000 when its stoker heating system succumbed to the elements. For 24 hours workers fired the boilers by hand as best they could to protect the life of plants in the bulb stage as well as stock on hand. Temperature was dropped on the more hardy plants and raised on the less hardy until a new diesel electric set could be installed. The set, put into operation before time could be taken to install it permanently, stood outside the greenhouse but ran without complaint until electric power was returned. The unit will see standby service as insurance against a recurrence.

A diesel electric set, put into operation before time could be taken to install it permanently, ran without complaint until electric power was returned

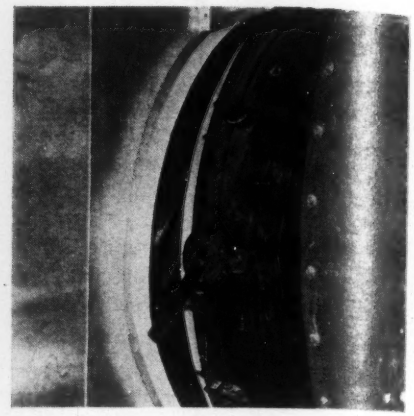


Fig. 1 (left)—To make a flexible connection between the fan and duct system at a pharmaceutical laboratory, the first step was to apply double coated tape to both metal flanges. Fig. 2 (center)—Rubber coated fiber glass fabric was then held in place by the tape applied in Fig. 1, and was sealed with single coated tape. Fig. 3 (right)—The finished duct connector forms a tight seal between the metal and the fabric

How Two Plants Met Problem of Forming Airtight Seals

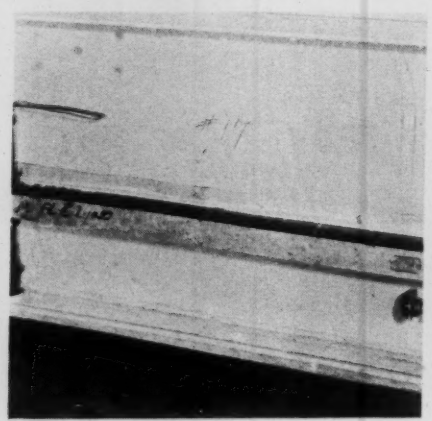
PRACTICAL POINTERS on how a pharmaceutical laboratory and a steel plant recently met problems of making airtight seals required for flexible duct connectors, convector radiators, filter banks, and fume exhaust stacks are given in the "on the job" pictures reproduced here

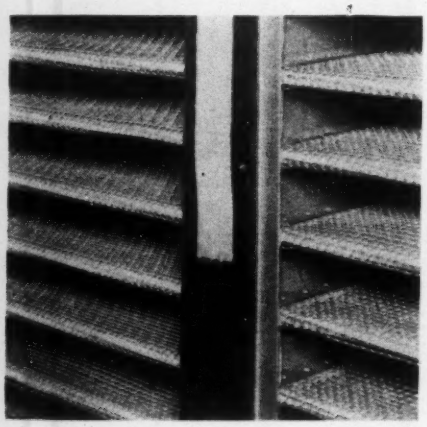
FLEXIBLE DUCT connectors to prevent vibration from the fan being transmitted to the duct system in a new building at the Abbott Laboratories, North Chicago, Ill., were made by utilizing a war-developed industrial adhesive tape, which comprises a fiber glass cloth backing coated on either one or both sides with a vulcanizable adhesive.

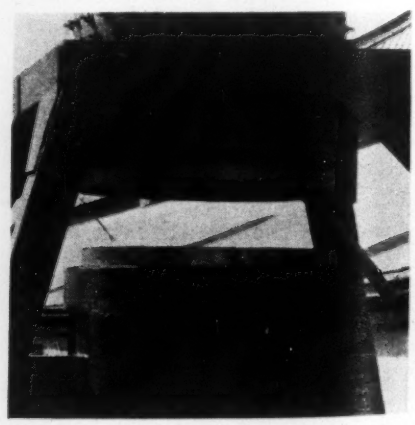
To make the duct connectors at this building, strips of double coated tape were first applied to the two metal flanges, as shown in Fig. 1. In the next step, Fig. 2, a piece of rubber coated fiber glass fabric was held in place by the previously-applied double coated tape and then sealed by strips of single coated tape. The third "on the job" photo, Fig. 3, shows the finished connector, tightly sealed to the metal so that there is no "air pocket" between it and the fabric.

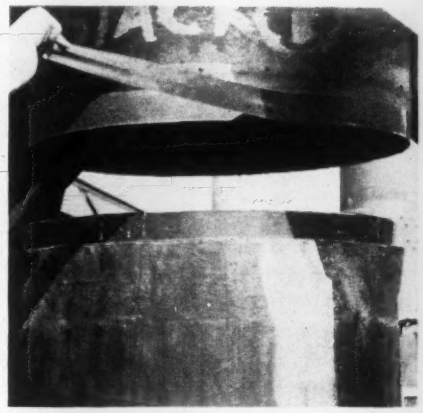
Another "sealing problem" at the same building involved some of the convector radiation. The heating elements and the convector en-

Fig. 4 (left)—A seal between a convector radiator and the back of its enclosure to prevent air from bypassing the heating element was made in this manner at the laboratory. Fig. 5 (center)—Here is the method used to seal the joints in a filter bank at the same building. Fig. 6 (right)—First step in installing new connectors on these exhaust stacks from pickling vats at a steel mill was to clean the flanges of all dirt, oil, asphalt, other foreign material









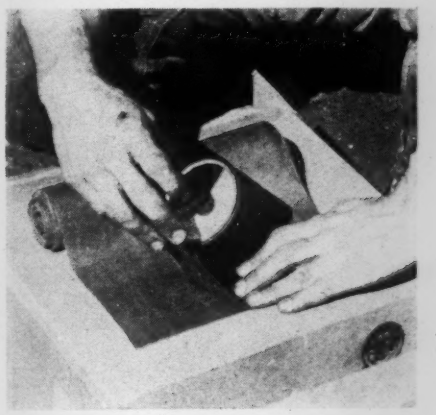


Fig. 7 (left)—Double coated tape was then applied to both top and bottom flanges. Fig. 8 (center)—The facing material was next removed from the tape applied in Fig. 7. Fig. 9 (right)—Tape was then applied across one end of the neoprene fabric which is to be used as the connector

closures were supplied by different manufacturers, and it was found necessary to seal the space between the heating element and the back of the enclosure to prevent air flowing upward through the convector from bypassing the finned element. As shown in Fig. 4, the space between the element and the back of the enclosure was sealed off with tape to assure that all air passing up through the convector would have to pass through the finned heater.

Joints in a filter bank in this same building were also sealed with tape, as shown in Fig. 5, to prevent any of the air bypassing the filtering elements.

Fume Exhaust Stacks

The flexible connections on fume exhaust stacks from pickling vats at the Acme Steel Co., Chicago, presented quite a maintenance problem, as they required replacement about every three months.

The series of photos reproduced as Figs. 6 to 12 illustrate how this problem has been met. The step-by-step procedure used at this steel plant was as follows:

a) After removal of old connector, clean exhaust stack flanges of all dirt, oil, asphalt, or other foreign materials (Fig. 6).

b) Cut neoprene coated fiber glass fabric to fit in such fashion that at least 1 in. of the flange will be exposed both top and bottom. This cutting includes the drain pipe hole.

c) Apply 2½ in. wide double coated fiber glass tape to both top and bottom flanges covering entire flange surfaces. There should be about 1 in. overlap of the tape where the two ends meet to assure complete flange covering (Fig. 7). Remove the facing material on the tape, taking care to leave a tab of facing material beyond the end of the tape (Fig. 8).

d) Apply tape completely across one end of the neoprene fabric, leaving facing material in place but with a tab of facing material exposed to facilitate removal (Fig. 9).

e) Apply the neoprene cloth to the flanges, leaving the tape on the flanges exposed at least 1 in. on either flange. The neoprene cloth is applied so that the drain spout extends through the hole previously cut (Fig. 10).

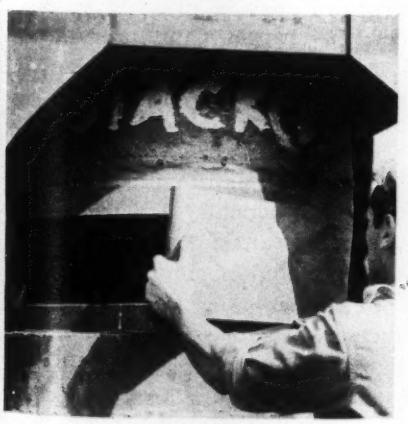
f) To splice the neoprene fabric, remove the facing from the tape previously applied to the end of the neoprene fabric and bring the other end of the neoprene fabric in contact with the exposed adhesive face, pressing down tightly (Fig. 11).

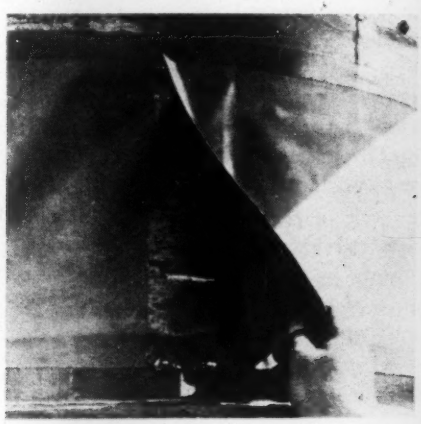
g) Apply 2½ in. single coated tape as a final seal around both flanges and down the splice prepared in Step "f" (Fig. 12).

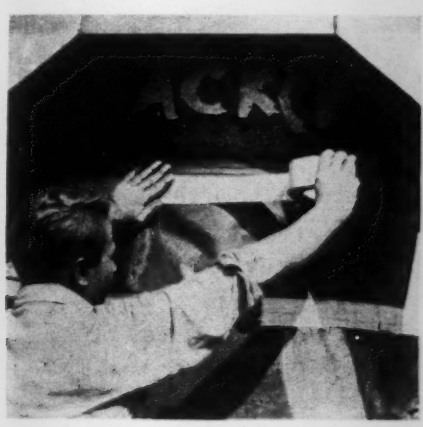
h) Seal drain opening with 2½ in. single coated tape.

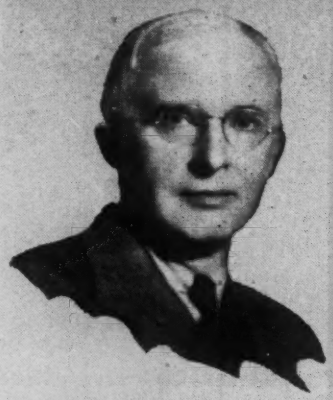
Photos courtesy Bauer & Black, Div. of Kendall Co.

Fig. 10 (left)—Next, the neoprene fabric was applied to the flanges, which were taped in Fig. 7. Fig. 11 (center)—To splice the neoprene fabric, the facing was removed from the tape previously applied to the fabric and the other end of the fabric was brought in contact with the now-exposed adhesive on the tape. Fig. 12 (right)—Single coated tape was next applied as a seal around both flanges and down the splice









SAM LEWIS' PAGE

Informal comment on heating, piping, and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, member HPAC's board of consulting and contributing editors

Oxygen and Suction Piping for Hospitals

Practical pointers on the requirements for central oxygen systems and piped-up central suction systems as used in hospitals are given here by an engineer who has been responsible for the design of the mechanical equipment in many hospital buildings

MECHANICAL EQUIPMENT of hospitals always is interesting, from boilers to incinerators, and from central air conditioning to refrigeration for food storage. A hospital seems to need almost every facility —from those of a chemical laboratory to those of a hotel.

So rapid are the developments that apparently ultramodern items of equipment installed today may be obsolete next year. Employment of oxygen, especially in pulmonary and cardiac therapy, is a case in point. No longer is it acceptable to wait for an orderly with his wrenches and reducing valves and gage to wheel in the tank on a truck and then to perform the clumsy operation of making connections. The preferred method is to provide permanently piped-up oxygen services in all operating rooms and in as many wards and single rooms as may be feasible. Similarly, a manually operated portable piston pump no longer is acceptable for evacuating, but a piped-up central suction system is called for. This is especially necessary in laboratories, operating rooms, anesthesia rooms, and frequently is specified for at least half of all single rooms and for each two beds in large wards.

Central Oxygen System

A central oxygen system usually comprises a rack or stand for 10 or more liquid oxygen cylinders. There is a welded steel or copper manifold with sweated joints having 10 copper leads, one for each cylinder. The leads each have a check valve between the tank and the manifold, opening toward the latter so as to prevent loss of oxygen from other tanks by reverse flow in case of failure or leakage in any tank. The manifold will have two low pressure shutoff valves, two pressure relief valves, and two pressure regulators or reducing valves. Each oxygen tank carries its individual safety pressure relief disk in the individual valve. The manifold is arranged so that oxygen is allowed to flow from only half of the cylinders at any one time, the other cylinders being held in reserve.

When the supply of oxygen from the first half of the group of cylinders fails, the remaining cylinders commence to serve automatically. After this change-over takes place, the exhausted cylinders can be replaced with full ones. A signal system should be arranged always, to indicate necessity of cylinder replacement. This may comprise a pressure gage, a pressure-operated electric switch, and an electric light or an alarm bell. If the oxygen pressure drops, the pressure may no longer hold open a spring-closed circuit. It is desirable that the oxygen manifold room be located conveniently for delivery of the heavy tanks. These tanks must be protected from contact with steam pipes or with any other hot surface, since expansion of the gas by heat can build up a great increase in pressure and may cause

opening of the safety devices. Space must be provided in the oxygen manifold room for storage of at least double the number of active cylinders.

Large hospitals, or hospitals where oxygen therapy is used extensively, may be supplied from batteries of large horizontal cylinders. These cylinders are recharged periodically from the oxygen supplier's truck. Another oxygen service organization uses oxygen tanks mounted on trailers, the entire tank and trailer being exchanged for a charged duplicate as frequently as may be necessary.

The oxygen piping is of seamless copper tubing with sweated joints. In an average hospital having up to 200 beds, one 1 in. main line and a ¾ in. riser at each zone usually is ample. A manual valve at each branch main and at each riser is recommended. At the oxygen outlets in the rooms, ½ in. pipe connections are provided, and there may be a needle type brass valve or any special valve as may be required for specific administering apparatuses.

The outlet generally is 4 ft above the floor, in a wall. It is important that no unauthorized person be able to tamper with the oxygen valve, and a metal enclosing box provided with a secure lock and key is recommended. The oxygen outlets all must have identifying signs of permanent type. All valves on oxygen piping must have wired on and sealed identifying tags.

Oxygen Piping Must Be Free of Oil and Grease

Valves should be designed for 400 psi pressure and must be taken apart and washed free of all oil, then re-assembled and packed with dry asbestos packing. The entire oxygen piping system must be free of oil or grease, since the latter in contact with oxygen creates a dangerous explosion hazard. To this end, all pipe, valves, and fittings must be washed in a hot solution of 1 lb of sodium carbonate or trisodium phosphate to 3 gal of water and then rinsed in clean water.

The entire oxygen system must be tested, section by section, between valves and must be proved tight at not less than 200 psi pressure. The test pressure may be obtained with air or oxygen, but the pump must be a water pump arranged so that there shall be no possibility of entry of any lubricating oil. Leaks can be found by use of soapsuds. Oxygen piping should be painted a distinctive color.

Design of Suction Piping

Suction piping generally is desirable in rooms used for the same purposes as those in which oxygen outlets are provided. The pump preferably is an electric driven centrifugal, and is water lubricated, designed to maintain a minimum of 9 in. and up to 15 in. of mercury below atmospheric pressure.

There is a steel suction tank to which the various vacuum piping systems are connected. The piping may be of steel, welded or threaded, or of copper with sweated joints. Standard thickness pipe fittings and valves may be used.

Intakes in rooms have special valve and bottle appliances whereby the suction pressure may be regulated and where any matter foreign to the normal air or gas may be separated and retained. A locked protective cabinet at each inlet is required, and there should be provided sectionalizing valves, identifying colors, etc., in the same general manner as described for the oxygen system.

Required Suction Capacity

The suction pumps should be in duplicate, and each one should be designed to handle at least two-thirds of the total calculated peak demand. The following is a table of design suction capacity approved by the government:

	Cfm	Percent of Simultaneous Use
Laboratories	1.0	40
Dental	0.5	20
Operating room	2.0	100
Single room or two-bed ward	1.0	20
Surgical acute and single decompression (TB)	2.0	100
Surgical recovery and anesthesia	1.0	20
Eye, ear, etc., operating	0.5	20
Bronchography (TB)	1.0	100

Each pump suction is connected from the top of the suction tank through a manual valve and a check valve. The discharge pipe from each pump goes to the atmosphere through a noise muffler. City water for sealing and lubricating enters through an automatic valve for each pump, following a vacuum breaker in the city water line to prevent any possible reverse flow into the water mains.

Each automatic valve (usually a solenoid or magnetic valve) has a union and a valve on each side of it, with a valved bypass around the assembly so that in emergency the automatic valve can be removed. The tank has a vacuum regulator for each pump that controls the respective motor and lubricating water inlet valve. There is a pressure relief valve on the tank. The pump motors have magnetic switches and manual disconnect switches.

DISMOUNTING TIME FOR BEARINGS CUT

A more economical and time-saving method of removing large antifriction bearings from machines—in minutes instead of hours—is now being applied by an increasing number of manufacturers, according to Dr. Haakon Styri, director of research for SKF Industries, Inc.

By pressuring oil from a hand operated hydraulic pump between the bore of the bearing and the shaft on which it is mounted, Dr. Styri pointed out, the inner ring expands and "floats" on the oil film, enabling the operator to remove the bearing with greater ease and in less time. The method, introduced to industry by the ball and roller bearing firm, is also successful for coupling two shafts together, he said.

The application of oil at 7000 to 8000 psi reduces dismounting time to 10 or 15 min, he said, as compared with several hours required by the former method involving use of pullers and hydraulic jacks.

OHIO STATE OFFERS DEGREE IN WELDING

Establishment of a department of welding engineering, the first of its kind in the nation, was announced last month at Ohio State University by President Howard L. Bevis. The new department will offer undergraduate work leading to the degree of bachelor of welding engineering and advanced study for graduate engineers.

A pioneer in the field of welding engineering, Ohio State has offered a curriculum in this field for some nine years, as a division of the department of industrial engineering.

It Is Not True That St. Louis Smoke Ordinance Doesn't Work!

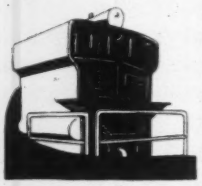
DURING THE PAST few months an attempt apparently has been made by certain high volatile coal interests to discredit the accomplishments of the St. Louis smoke ordinance. [See HPAC, November 1947, page 80; December 1947, page 100].

The impression has been conveyed that the St. Louis ordinance, after nearly seven years of successful operation, has collapsed. The arguments presented to substantiate these claims may be briefly summarized as follows: (1) That low volatile fuel smokes, (2) that airplane flights had to be cancelled on one day in August 1947, (3) that the deputy commissioner of smoke regulation of St. Louis said that, "Atmospheric conditions are rotten", (4) that the smoke records of two months in 1939 were better than two corresponding months in 1944, (5) that 72 percent reduction in smoke claimed is based upon flimsy premises, (6) that St. Louis would not need its 26 to 30 employees in the smoke division if smoke had been eliminated, (7) that the soot-fall in Cincinnati in September 1947 was greater than in September 1946, (8) that I quoted a statement that "there are 177,000,000 tons of low volatile *coal* available yearly", and (9) that St. Louis is having trouble in getting low volatile coal.

The following is an answer to each of the above claims:

1) Low volatile fuel does smoke. The only solid fuels that may be truly classified as "smokeless" are byproduct coke and anthracite coal. However, R. J. Piersol, in a bulletin published in 1936 by the Illinois Geological Survey, shows that the smoke making characteristics of Illinois coal as compared to West Virginia coal have a straight line relationship; to be specific, West Virginia coal as used in St. Louis makes 50 percent less smoke than the best grade of Illinois coal. Thus, by changing the fuel St. Louis immediately reduced the smoke from hand fired furnaces 50 percent.

2) The cancellation of airplane flights on one day in August 1947 does not appear to be a sound argument against the St. Louis smoke ordinance. St. Louis, like many other cities, has had flights cancelled for a variety of reasons. If after seven years only one day can be cited when flights have been cancelled, it would appear that St. Louis has really solved her smoke problem. St. Louis has never claimed perfection. There is much work still to be done and proper steps are being taken to accomplish this.



3) To the best of my knowledge, John Monie, deputy commissioner of smoke of the city of St. Louis, did not say that "atmospheric conditions in St. Louis are rotten". He did say that fly ash resulting from the burning of high ash high volatile fuel had created a "rotten condition" in the summer months when no low volatile fuel was being burned. Fly ash and smoke are not synonymous.

RAYMOND R. TUCKER, former smoke commissioner of St. Louis, summarizes nine different points that have been made to the discredit of the St. Louis smoke ordinance, and then answers each of the nine in some detail. St. Louis is famous for its ordinance prohibiting the burning of high volatile coal in hand fired heating and other plants

4) St. Louis, as is the case with many other cities, is not interested in isolated examples. For every month that has been chosen to show the failure of the St. Louis smoke ordinance, many others may be selected to show its success. The overall picture is a far better and more rational criterion. H. F. Wahlgren, meteorologist, Weather Bureau U.S. Department of Commerce, addressed a letter on May 7, 1947, to James H. Carter, commissioner of smoke regulation of St. Louis, containing the following statements and table for the first five years of the St. Louis smoke ordinance:

72 Percent Reduction in Hours of Smoke

"The official records of our office, which are reliable and accurate, prove conclusively that there has been a great improvement in conditions, as far as smoke is concerned in St. Louis, since the smoke ordinance became effective. No other conclusions can be drawn from these figures, taken from our records, and which are set forth below, for the heating seasons September to March, inclusive:

Heating Season	Hours and Minutes of Smoke		
	Moderate	Thick	Combined
1939-40	599:00	117:30	716:30
1940-41	178:00	19:15	197:15
1941-42	157:45	26:20	184:05
1942-43	127:10	14:50	142:00
1943-44	231:50	19:20	251:10
1944-45	156:38	33:20	189:58

The heating season of 1939-40 was the last before the low volatile clause went into effect in St. Louis. The heating seasons of 1945-46 and 1946-47 are not included in this table because the Weather Bureau changed their standards of measurements—in fact they became more lenient.

5) An analysis of the figures presented by Mr. Wahlgren shows that

72 percent reduction in hours of total smoke in St. Louis is not an unreasonable claim.

6) Again a questionable argument is used when it is implied that St. Louis would not need any employees in the smoke department if the smoke problem had been solved. The work of enforcement is endless. The gentleman who has used this argument knows this—or at least this was his thought when he made the following statements in a prepared address before the Smoke Prevention Association meeting in Minneapolis in June 1946. The following are his statements:

"We all know that we will never achieve smoke abatement merely by making surveys and presenting recommendations. A workable ordinance, with teeth in it, is the final answer. Furthermore, THERE MUST BE ENFORCEMENT by a staff adequate to handle the problem."

. . . "or still worse, to have the ordinance adopted and then administered by an underpaid and undermanned smoke department."

So why begrudge St. Louis an ordinance "with teeth in it" and an adequately manned smoke department?

7) The quoted figures on sootfall in September 1947 for Cincinnati as compared to September 1946 are, in my opinion, not indicative of the smoke in the atmosphere. Several articles recently published show that there is no correlation between dustfall and the type of fuel that is being burned. Furthermore, this comparison is rather ineffectual because the smoke ordinance in Cincinnati requiring the use of low volatile fuel was passed only in March 1947. During the month of September very little (if any) domestic fuel was used, and if it was used, in all probability it was high volatile fuel which still remained in the bins from the last heating season.

8) I have been quoted as saying there were 177,000,000 tons of low volatile *coal* available yearly. I did not say there were 177,000,000 tons of low volatile *coal*, but 177,000,000 tons of low volatile *fuel*, and in order that there might be no misunderstanding, I went on to say this included coke, briquettes, etc. So the argument of the high volatile representative on the production of the Pocahontas field, although interesting, has no bearing on the statement.

9) It is agreed that low volatile fuel is hard to obtain, but so is gas, oil, and high volatile solid fuel. Any effort which may be made to obtain low volatile fuel is fully compensated for in its use and the results it produces.

Is Public Opinion Enough?

In addition to the above answers to claims made by the high volatile representative, exception is also taken to the categorical statement that any progress that has been made in St. Louis "came through the awakening of the public consciousness against smoke and by applying engineering principles to solve individual smoke problems." For the past 75 years St. Louis has been very conscious of her smoke problem—in fact so conscious that $200,000 was collected by private subscriptions in 1926 to teach the citizens of St. Louis properly to hand fire high volatile coal. Subsequent to the expenditure of this money, St. Louis had the worst smoke palls in her history.

It may be further noted that throughout this whole period the engineering talent in St. Louis was on a par with that which now exists in the city. Still, this engineering talent alone—and the public consciousness of smoke—did not solve the St. Louis smoke problem. Even engineering talent cannot work miracles. St. Louis solved her problem only after there was placed in the hands of the individual users of fuel, fuel and equipment that was suitable for their particular use.

It is hoped that any future criticism of the St. Louis ordinance will be more specific and constructive. St. Louisians do not, as has been said, claim perfection, but they do claim that the methods adopted resulted in a 72 percent reduction of smoke.—RAYMOND R. TUCKER, professor and head of department of mechanical engineering, Washington University, St. Louis, formerly, smoke commissioner, city of St. Louis.

DIRECTS GAS PRODUCTION RESEARCH

Dr. Newcomb K. Chaney, for the past 12 years director of research for the United Gas Improvement Co., has been appointed to direct the gas production research program of the American Gas Association. He takes charge of the work previously directed by Edwin L. Hall, who has been appointed director of the association's testing laboratories at Cleveland and Los Angeles.

"OPEN FOR DISCUSSION"

DO YOU HAVE something to say about any of the articles published this month? An additional comment, or perhaps a question on some point? We follow here the custom of engineering society meetings in allowing a period for discussion following presentation of a paper. You are invited to contribute your views. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

RADIANT HEATING AND UNITS IN FIELD HOUSE

The Mott memorial field house, of which the shower and locker room areas were opened to the student body last fall, is the first building at Stevens Institute of Technology to make use of radiant heating. The system consists of copper pipes laid on gravel in the concrete floor over the whole 26 by 147 ft area. In addition, the building also has unit heaters on the walls.

IBR DISCUSSES ACTIVITIES, ELECTS OFFICERS

The field training program, the advertising campaign, and the IBR short courses were some of the discussion highlights at the 1947 annual meeting of the Institute of Boiler and Radiator Manufacturers.

Officers elected for 1948 are C. M. Baumgardner, executive vice president, United States Radiator Corp., chairman; W. C. Murray, vice president and treasurer, Utica Radiator Corp., vice chairman; and R. E. Ferry, general manager and treasurer.

[*Be sure to preserve the complete Directory Section of Heating, Piping, and Air Conditioning Equipment published in last month's issue for use throughout the year.*]

Practical Pointers on Operation of Air Conditioning Installations

In his article on air conditioning plant operation in the January issue, Donald A. Kepler stated that where consulting engineers design the system and select the equipment, the burden of achieving fine operating results depends upon the air conditioning operator and his organization.

I agree with Mr. Kepler 100 percent, and wish to add that it has been my experience that almost always a new air conditioning system needs one or two (and often, several) design changes made in it before it works satisfactorily. It is not always feasible to contact consulting engineers on these changes and quite often, the problems end up in the lap of the operating engineer. In these cases, the operating engineer must have a background of technical knowledge sufficient to enable him to diagnose the trouble and make the necessary changes.

It is always necessary to keep air conditioning systems operating efficiently in severe weather to achieve desired results, provided the system has been designed economically and without exorbitant factors of safety. It has been repeatedly demonstrated that it is more economical to design a system with a reasonable factor of safety and then to rely upon competent operators to keep the system in adjustment than it is to use a factor of safety of perhaps two and then let the system run unattended.

It can be readily seen that a system cannot be operated economically unless (1) there are sufficient operators to keep the equipment in balance and in repair; (2) an efficient organization of their duties and responsibilities to utilize properly their time; (3) sufficient skill and know-how in the group to enable them to solve their problems; and (4) an operating and maintenance schedule to aid them in their inspection and repair of equipment in the system.

Under the heading "Functions of Operating Organization," Mr. Kepler mentioned that the air units must be operated by day-to-day judgment and hour-to-hour adjustment. I would like to ask this question: Wouldn't automatic controls make the necessary adjustments in the air handling equipment to maintain desired conditions in air conditioned spaces?

It would seem to me that temperatures and humidities in important rooms should be taken daily together with inspection of compressor oil level, suction pressure and head pressure, but that no adjustments would need to be made in the air handling equipment hour-by-hour unless one or more pieces of equipment were not operating properly and this should not occur very often if the proper inspection and maintenance schedules were followed.

I agree quite heartily with Mr. Kepler that the maintenance of "heavy equipment" can best be cared for by the engine room force. It is usually desirable to centralize heavy equipment, such as centrifugal compressors, in one place where they can receive the expert and constant attention required by modern high capacity, high speed machines. It would seem desirable to pipe chilled water or brine from one central location to coils in air handling equipment and thus obviate the necessity of designing, installing, and maintaining refrigeration compressors which would be scattered throughout a plant.—B. G. Evans, engineering dept., Eli Lilly and Co., Indianapolis.

RATING OPERATION OF AIR CONDITIONING

The rating system for air conditioning plant operation, as proposed by Donald A. Kepler in the November issue, should be productive of beneficial results. However, experience does not show that design can be considered as essential insurance of satisfactory performance. Any system must necessarily have a great capacity for making the occupancy—either by people or by hygroscopic- and temperature-responsive materials—decidedly undesirable by reason of the built-in ability to care for widely separated extremes of design conditions.

Specific training of the operator, his air conditioning design and layout experience, and his personal checking of each complaint are given a rating by Mr. Kepler of 40 points of the total of 100. This evaluation is much too high, on the qualifications as expressed. Ratings should be incorporated on the actual ability of the operator under all weather and load conditions, familiarity with any processing of specific materials, as well as full knowledge of the thermal and moisture barrier characteristics of the enclosure. Further, men should be competent to operate the system with the automatic controls out of service. Authority and ability to change the system as required are vital, and diplomacy in dealing with occupants deserves consideration.

The scheduling of "tours of duty" of qualified personnel deserves stronger emphasis than the 10 points given, especially that tours of qualified personnel must mean frequent and actual physical examination of the controlled areas. A substantial allocation should be made for this item—at least 25 percent or more when adequately performed, not the 10 percent as given.

Regarding the matter of operating records, anticipatory guidance on the basis of past records should be established from such logs, to permit preparation for peak demands *before* emergencies arise.—Rush D. Touton, technical director, Bayuk Cigars Inc., Philadelphia; member of HPAC's board of consulting and contributing editors.

"LIKE PREACHING TO THOSE ABSENT"

H. E. WHEELER'S article, Air Conditioning Buyers Know Lots About It That "Ain't So," in the January HPAC, is very much to the point. It does seem, however, a good deal like the minister preaching to the people who come to church on the sins of those who are absent. Readers of HPAC know all of these things all too well, and it is probably impossible to get these suggestions in the hands of the "less informed customers" to whom Mr. Wheeler directs his remarks.

His comment on the design conditions for air conditioning for comfort again emphasizes how we confuse ourselves when we talk about comfort. We must get air conditioning design temperatures and humidity nailed down for *health*. Comfort means nothing. Some people claim they are comfortable sleeping on hard ground in a tent in the cold rain—it all depends on your point of view. Air conditioning for health should not be debatable but should be a condition of life.

Mr. Wheeler's rattling of the old skeleton of shock going from a hot street into a cold store, or vice versa, brings to mind the fact that there are thousands of industrial workers in damp cold storage plants and other refrigerated occupations who pass from really cold rooms into hot warehouses with no complaint of shock. These are not considered hazardous industries or unhealthy occupations. It is time we buried this specter as no one has been able to prove anything about shock and I think it originally came from the jealous storekeeper who didn't have air conditioning and wanted to set up an alibi to satisfy his conscience or his public.

In discussing first costs, Mr. Wheeler hits the nail on the head when he says that air conditioning equipment cost has not increased as much as the super-duper efficiently built automobile. As a matter of fact, much of the increase in cost of air conditioning equipment is due to actual improvement of design, and I don't think we can say the same thing about the automobile. Our industry has no apology to make for price.

When Mr. Wheeler mentions 25c a day per employee as the owning and operating cost of air conditioning, he is far too conservative. On many office jobs where we have analyzed the figures, we find that it is less than 1 percent of the payroll cost per year to own and operate complete year around air conditioning. This does not give any credit for ordinary heating and ventilating which would be required regardless of the conditioning. Twenty-five cents per day is almost twice what we would consider a fair cost.

Every article of this kind helps to clear up misconceptions. I am sorry that this particular article is not being carried in popular magazines that enjoy tremendous national circulations and are read by the "less informed customers."—LESTER T. AVERY, president, Avery Engineering Co., Cleveland.

REPORTS ON GERMAN CENTRIFUGAL MACHINES

Though no significant advances have been made in recent years in German centrifugal compressor manufacture, some construction details differ from American practices and are of interest, according to a report (PB-80358) now on sale for $1.25 by the Office of Technical Services, Department of Commerce, Washington 25, D.C.

The report, prepared by OTS investigator Philipp Goldman, reviews German design practices and construction methods for centrifugal gas compressors as observed at several German firms.

The Germans place special emphasis on methods for cooling the gas, the author states. "The work of compression, from a fixed suction pressure to a certain end pressure, becomes smaller as an isothermal process of compression is approached," he explains. It is practically impossible to reach the isothermal cycle of compression but two distinct cooling methods for approaching this cycle, one involving cooling the gas in the passages inside the compressor and the other, cooling chambers outside the compressor, are in use in Germany, the report states.

With the internal method, the air is cooled inside the compressor in the passages formed by the diffuser and return channel limiting the amount of cooling surface available. As the peripheral impeller velocities increase and more compression work is done per stage, the cooling surface inside the compressor becomes insufficient. Only the Gutehoffnungshutte still makes internally cooled compressors, according to the report.

Most German compressors are built for external cooling. The Demag firm uses three cooling chambers for its nine stage compressor. The arrangement of the cooling chambers permits the cleaning of the water or air side of the cooling surfaces without disturbing any of the structural members of the compressor.

In the "Isotherm" compressor, the gas is cooled after every stage except the first. The finned tube bundles are housed in two separate chambers on the sides of the compressor. The water side of the tubes may be cleaned during operation. To clean the gas side, the whole chamber has to be disconnected from the compressor body. The method of cooling the gas after every stage "is the closest approach to the ideal isothermal process of any of the constructions used by the German manufacturers," the author states. The construction is costly, "but since many of these compressors are in operation continuously, the power savings derived from the close approach to the isothermal cycle of compression may outweigh the higher capital investment."

The outstanding trend, the author states, is the increase in impeller speed which causes a decrease in weight for equal capacities and compression ratios.

"OPEN FOR DISCUSSION"

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Let's "Ventilate" These Radiant Heating Questions

ACCEPTING THE invitation of Samuel R. Lewis to comment on his page entitled "Let's 'Ventilate' These Heating Questions" in the October HPAC, I feel that there hardly can be "two schools of thought" with reference to the proper location of piping in radiant heating installations, as there is no one design that is applicable to all cases.

With concrete floor slabs in basementless constructions, at least some coils should always be placed in the slabs. In many cases, these coils will be sufficient, but where the required heat input calls for floor temperatures in excess of 85 F, additional radiating coils should be provided. This can be done by providing higher floor temperatures in areas not ordinarily traversed, such as the borders of a room, or by making use of ceiling or wall coils (the latter, however, should be avoided, if possible) so that in cases where adequate heat input to a room cannot be obtained from a floor installation without exceeding a floor temperature of 85 F in the well traversed room areas, additional coils should be placed in the ceiling.

The particular reason for heating concrete floors is that with floor temperatures less than foot temperatures, the loss of heat through the feet by conduction causes the tiring effect commonly associated with concrete floors and improperly assumed to be due to the hardness of the floor. Warming the floor to foot temperature, at least, eliminates this feeling of discomfort.

With other types of building construction, particularly wood frame residences, the ceiling is the proper location for coils, as it more nearly approximates natural conditions, as Mr. Lewis states, and allows for a greater heat input to a room than does a floor system. But it is possible to have too hot a ceiling, especially if it is relatively low, such as 7½ to 8 ft. Ceilings heated excessively with respect to their height will cause the occupants to be quite uncomfortable without knowing exactly the reason for their discomfort. In addition, they will also be likely to have headaches.

I believe Mr. Lewis is entirely correct in stating that floor pipes should be installed directly in the concrete and not on subslab material. The pipe or tubing should be reasonably close to the top surface of the slab to reduce the heat inertia between the heating fluid and the floor surface. When properly installed, either steel or wrought iron pipes or copper tubes can be used with perfect confidence.

In ceiling installations, iron pipe can be placed above the metal lath, preferably with suitable reflective surfaces and insulation to direct the heat, or copper tube can be placed below or above the metal lath entirely as convenience or cost dictate.

With respect to corrosion and leak damage, experience both here and in Europe indicates that with a closed recirculating system, no difficulty should be had from this source, but every installation should be properly and carefully tested before being enclosed to ensure that all joints are tight and mechanically strong.

Therefore, the answer to the questions as to location, pipe material, size, and spacing is that any location and any commercial pipe material will provide a satisfactory radiant heating installation if properly designed. In fact, the general arrangement of the coils, their type, points of feed, and other considerations are worthy of far more careful thought than the question of location (floor or ceiling) and material to use. The proper answers to these questions can be made only by engineers thoroughly familiar with radiant heating application and design.—RICHARD W. SHOEMAKER, Thermo-Radiant Consultants, Oakland, Calif.

CAN'T USE SUN HEAT AS A COMPARISON

FOR SOME TIME now I have followed with interest the feature in HPAC known as Sam Lewis' Page. A man of Mr. Lewis' intelligence and experience must carry considerable weight with other readers and thus I felt it necessary to prepare a reply to his article "Let's 'Ventilate' These Heating Questions," in the October number.

I want to congratulate Mr. Lewis on his willingness to discuss such a controversial subject as radiant heating. While I have great respect for the opinions of capable, experienced men of Mr. Lewis' standing, there are some points in his article that I am inclined to question on the basis of my knowledge of radiant heating gained over a period of four years of almost continuous study and observation.

Mr. Lewis seems to have fallen victim to the same line of comparative reasoning that other writers of radiant heating articles have subscribed to. That reasoning involves the comparing of the sun and its heating effect upon the earth to a ceiling type radiant heating system and its effect upon the occupants of the room. So much of the sun's heat is reradiated from the earth and other objects that it would be quite difficult to credit direct exposure to the sun as providing the ultimate in comfort conditions. In addition, while I have been undeniably warmed by the sun on a cold day, I find it quite impossible to be

comfortable under these conditions if my feet are cold. Furthermore, I am sure that Mr. Lewis and others can remember those childhood days when most of us ventured outside with wet, freshly combed hair on winter days. Personally, neither I nor any acquaintances experienced discomfort, whereas I am certain we would have been most uncomfortable had we gone outside without our shoes. My grandmother also tells me of the warm bricks they used to prepare for cold winter nights, these bricks being placed at the foot of the bed for maximum effect. On the other hand, I can find no evidence that these same warming devices were placed under pillows or other places adjacent to the upper portions of the body.

I am not familiar with the details of Mr. Lewis' experience with ceiling and floor systems, but I am certain that I have been in a position to observe a considerably greater number of installations because of my advantageous position with respect to radiant heating. I have found that improper design, installation, and control can cause trouble with both types, just as faulty workmanship and equipment specifications can present problems with any other type of heating system. Thus, unless we are in possession of all of the details of a specific installation it is difficult to come to any conclusion concerning the cause of any difficulty which might arise.

While Mr. Lewis has made the general inference that floor systems are difficult to control, my wide experience forces me to state that Mr. Lewis' conclusion does not coincide with that of the majority. Along this line, it is interesting to know that there are specific cases on record where the installation of complex control equipment has proved to be the cause of a control problem which was completely solved by the substitution of simple control devices.

Mr. Lewis touches briefly on the corrosion problem and yet he seems to have covered only the lesser phase of the subject when he limits his discussion to internal corrosion. All of the engineers, architects, and contractors with whom I have had the privilege of discussing the subject of radiant heating have agreed that it is the possibility of external corrosion which calls for the selection of a durable piping material. Their opinion has been borne out by experience.

The question raised by Mr. Lewis concerning the streaking of plaster surfaces with tubing embedded in the plaster below the lath material is certainly justified, for cases of this kind are already on record. In two instances I am familiar with, the very noticeable streaking could not be permanently removed or prevented even by two and three coats of high quality paint. On the contrary, the many wrought iron jobs I have observed, where the piping is above the lath, have exhibited no marking of any kind.

In conclusion, I should like to assure Mr. Lewis and others who may read his page that I, too, have an open mind on the subject of the location of radiant heating piping and that I have, during the past four years, suggested or approved to the limit of my responsibility both ceiling and floor type installations. For the sake of the record, however, I should like to state that a survey of over 1000 installations revealed that the floor had been selected in 93 percent of the cases. —PAUL S. PARK, manager, engineering service dept., A. M. Byers Co., Pittsburgh.

SUGGESTS CENTRAL HEAT TO ABATE SMOKE

IT IS MY OPINION that neither the coal producers nor the city officials wrote objectively in the November issue of HPAC on the matter of smoke abatement. The issue of abating the smoke nuisance is of paramount importance to every American citizen.

Damage done by smoke represents a tremendous waste in clothing, decorating, building cleaning, street cleaning, and in the natural resource of fuel itself. It is one of the paramount causes for the decentralization of large metropolitan communities, thereby tending to dissipate a versatile labor source. It affects in an adverse manner our whole standard of living.

I suggest that well informed operating mine owners, public officials, and the heating industry in general forcefully bring to the public's attention the need for a basic approach to the problem. I suggest consideration of the following:

"OPEN FOR DISCUSSION"

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a) Extension of central heating systems either through a partial subsidy on the part of the coal operators or by intelligent airing of the problem and passage of laws permitting central systems to be more economical to the user than the individual plant. This is in the public's best interest.

b) Conversion of solid fuel to gas, oil, or other smokeless fuel at the minehead. I am informed that such a program is now in the pilot stage. —SILAS CARTLAND, consulting engineer, Park Ridge, Ill.

"AGREES EXACTLY WITH OUR VIEWS"

WE ARE VERY much impressed with the article in the January HPAC entitled Air Conditioning Buyers Know Lots About It That "Ain't So," by H. E. Wheeler of the Air Comfort Corp. We feel that everyone of our customers would better understand the use and performance of their systems after reading this article, and we also feel that everyone of our prospects would be easier to handle after reading it. It agrees exactly with what we have been trying to convey to the public for years.

Wants 50 Reprints

If at all possible, will you please send us 50 reprints of this article. We would very much like to have at least three reprints as rapidly as possible.

You may invoice us for whatever costs are involved.

Thank you for your cooperation. —I. F. LEGRAND, Air Engineers, design and construction, Allentown, Pa.

Card No. 56
Job No. ___

___ CUTTING AND PATCHING: All necessary cutting and patching of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under the contract shall be done at the Contractor's expense in a neat, workmanlike, and careful manner, and as approved by the Architect Engineer.

No wood or concrete joists, beams, girders, or columns shall be cut by any Contractor without first obtaining the written permission of the Engineer Architect.

All drilling and patching for expansion bolts, shields, hangers, and other supports shall be done by this Contractor, subject to the approval of the Engineer. Labor and materials required to replace or refinish parts cut or injured shall be furnished at this Contractor's expense, subject to the satisfaction of the Engineer Architect.

Card No. 57
Job No. ___

___ VIBRATION ELIMINATOR BASES: Furnish and install vibration eliminator mountings for the evaporative condensers, air conditioning units, pumps _____ compressors condensing units. These bases shall be of an approved type of cork pads, rubber pads, rubber vibration dampers spring mountings. They shall be designed for and recommended by the manufacturer of the compressor condensing units to carry the actual load at each support.

Card No. 58
Job No. ___

(Steam)

___ PRESSURE TESTS: Before connecting to the equipment, covering up, and insulating, all water and heating piping shall be subjected to a hydrostatic test of 50 psig, the reading to be taken at the boiler, and proven tight against leakage when joints are being struck with a mallet.

After the completion of the entire heating system, it shall be placed in operation by the Contractor and tested under __ 5 psig steam pressure in the presence of the Engineer to demonstrate the effective operation of all component parts. The duration of the test shall be at least ___ six hours Fuel shall be furnished by the Owner.

(Hot Water)

Before connecting to the equipment, concealing in floor, walls, or ceiling, and insulating, all water and heating piping shall be subjected to a hydrostatic test of ____ 300 psi, for ___ two hours, the reading to be taken near the boiler when possible and proven tight against leaks. The piping should be tested in segments when it is found necessary to do so as in the case of piping concealed in concrete floors, etc.

After the completion of the entire heating system, it shall be placed in operation by the Contractor and tested under ____ 30 psi operating pressure in the presence of the Engineer. The duration of the test shall be at least ____ six hours. Fuel shall be furnished by the Owner.

Card No. 59
Job No. ___

(refrigeration systems)

___ TESTS AND CHARGING THE SYSTEM: After the erection of the compressors, copper tubing and cooling coils, the Contractor shall admit CO_2 gas into the refrigerant tubing and coils until the pressure as read on the gage shall equal or exceed 300 psig. The gage must be installed with a cut-off and relief valve for testing the zero setting. All parts of the system shall then be tested for possible leakage; and if no leaks develop after 24 hours of constant pressure, the pressure shall be relieved. If leaks develop in the finned coils, the same shall be immediately removed and replaced with new unit at no additional cost to the owner. If leaks develop in the fittings, the same shall be removed and replaced with new fittings. After the CO_2 test has been completed, the entire system shall be continuously purged with a suitable vacuum pump to not less than 25 in. mercury as indicated on a calibrated vacuum gage, said purging to continue at least 6 hours and the vacuum to be held for 6 consecutive hours.

DATA SHEET

Simplified Procedure for SPECIFICATION WRITING

To meet a number of requests from readers for more information about the method described in George W. Campbell's article, A Simplified Procedure for Specification Writing, in the April 1946 HPAC, it was decided to run as a supplement to this article a series of specification cards which are used by the firm of Urdahl and Everetts, consulting engineers, in their Washington, D. C., and San Francisco offices. Mr. Campbell is employed in the Washington office.

Several of the cards have been published (and details of their use explained) in the June 1947-January 1948 issues inclusive, more appear this month, and others will follow. These specifications are not to be construed as recommendations to other consultants but to illustrate this card file used by Urdahl and Everetts.

Card No. 60
Job No. —

(air system)

ADJUSTMENT AND TRIAL RUN: After the Contractor has completed the air distribution system, he shall put all parts into perfect working order and shall adjust the system to deliver the specified quantity of air at the outlets. The system shall then be given a run of sufficient duration, as determined by the Engineer, to ascertain the proper operation of the equipment. After the installation of all the equipment, the air distribution system shall again be balanced according to the temperature and load requirements. The control system shall be tested in the presence of the Engineer and under his direction in such a manner as to show that it is installed according to the plans and specifications.

Card No. 61
Job No. —

(hot water heating system)

ADJUSTMENT AND TRIAL RUN: After the Contractor has completed the heating distribution system, he shall put all parts in working order, and the system shall be given a run of sufficient duration as determined by the Engineer, to ascertain the proper operation of the equipment. The control system shall be tested in the presence of the Engineer and under his direction in such a manner as to show that it is installed according to the specifications. The system shall be balanced by the adjustment of the square head cocks and flow control valve with all radiation valves full open to obtain the proper temperature in the respective return piping all the rooms. This balancing shall be done on a day that is sufficiently cold to give a fair test of the system. Fuel shall be furnished by the Owner.

(for radiant panel heating system only)

The system shall be filled in such a manner as to vent the air from the system without leaving any air pockets. The system will not be run at normal operating temperatures until the plaster and concrete are thoroughly dried out. This will be accomplished by setting the aquastat in the boiler to maintain water at the temperature of the air in the rooms at the time the operation is started and gradually increasing the temperature setting uniformly for a period of 7 10 days. The system will not be started until the Engineer has given his approval to start the initial operation.

Card No. 62
Job No. —

SHOP DRAWINGS: The Contractor shall submit for approval detailed drawings showing the arrangement of his equipment in the available locations fully dimensioned and drawn to — in. scale. Shop drawings shall also be furnished of units, control board, and control wiring diagram.

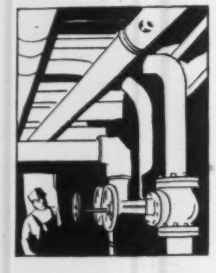
One set of the approved drawings must be on the job during complete construction and or erection of equipment and be available for inspection by the Engineer.

STEAM TRAPS

Types Available and Applications

HERE ARE two answers to a question published in our December issue that asked for information on the applications of the various available types of steam traps to heating, piping and air conditioning services.

THE FOLLOWING is submitted in answer to the question from "F.S." published in the December issue: "Which types of steam traps should be used for which applications?" I interpret the question to refer to separating traps rather than automatic return or lifting traps, and my discussion is accordingly limited to the "separating" type.



At the present time there are, roughly, five different varieties of separating traps in general use:

1) Thermostatic traps—valve is operated either by relative expansion of two dissimilar metals or by expansion of a volatile liquid contained in a bellows. They lend themselves to angle construction particularly well and are universally used on radiators of vapor and vacuum heating systems due to compactness, simplicity, and low cost. They also are extensively used on board ships, trains, etc., because their operation is unaffected by pitching and rolling. Another advantage they possess over other types is that they are inherently nonfreezing and therefore are particularly suitable for outdoor applications. These traps are slower in discharging condensate than the mechanical traps and also do not have a water seal on the valve. For this reason, they are more susceptible to wiredrawing. They are not used in power and industrial applications as much as mechanical traps due to this factor plus their usual pressure, temperature, and capacity limitations. Although not generally used on pressure above 30 psi, thermostatic traps have been built in rare instances for service up to 700 psi steam pressure by making the bodies of cast steel and the bellows and interior parts of stainless steel.

2) Float traps—now almost entirely superseded by the float and thermostatic type subsequently described. Has limited application for handling drips to wet return mains where air is taken care of by thermostatic bypasses, vents, or other means. [This type of trap, constructed of alloy materials to withstand higher pressures and sudden temperature changes, seems to be gaining in popularity, say some authorities—Ed.]

3) Float and thermostatic traps—built-in thermostatic element passes air and float valve passes steam. Condensate valve is water sealed but discharges more or less continuously and therefore is more susceptible to wiredrawing than valves in traps built for intermittent discharge. Necessarily bulky and generally used in high capacity applications such as draining blast coils, dryers, steam mains, water heaters, etc.

4) Bucket traps—made in two types, upright and inverted, both types having intermittent discharge. In both the inverted bucket and upright types, the valve is water sealed at all times. The inverted bucket trap has its discharge valve operated by an inverted bucket floating and sinking in a body always filled with condensate and its valve is always water sealed, assuming, of course, the trap has not lost its prime for any reason. Since inverted bucket traps must always be primed or full of water if they are to operate satisfactorily, they are occasionally installed with check valves ahead of the traps to prevent loss of prime if the traps are located in a position above the equipment they are draining, or if there is any liklihood of return line pressure ever exceeding supply pressure. They are used for substantially the same high capacity applications as float and thermostatic traps but their field of use

How Can We Simplify Operation, Maintenance?

You are invited to comment on the following question from "J.W." Suitable discussions of this matter will be published, and paid for at regular rates (with additional payment for sketches). Address The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"We want to make the air conditioning and ventilating equipment installed in our buildings as accessible as possible in order to simplify its operation and maintenance, with the idea of achieving better and more efficient results.

"One thing we have done is to install full-size sheet metal doors in the duct work to allow easy access to filter banks, etc., and these have proved a great help to the operating men.

"I'd be interested in any other practical ideas on how to arrange and install ventilation and air conditioning systems to promote ease of maintenance and operation."—J.W.

is extended somewhat over the f. & t. type because they are less affected by movement and vibration and are generally less bulky.

5) Impulse traps—a comparatively new type depending for operation on a moving valve actuated by a control cylinder. The actuating force controlling the movement of the valve is the variation in back pressure in the control chamber on an orifice which alternately passes water and steam. When passing steam, the back pressure builds up and causes the valve to close. With cool condensate at the trap, the back pressure is reduced by the constant discharge of condensate through the orifice which is always open. The reduction in control chamber pressure opens the valve, allowing the trap to discharge at full capacity until steam or hot condensate reach it again. The principal advantage of this type is in its compactness and absence of moving parts. They are currently built for pressures up to 600 psi and in sizes up to 2 in. The higher pressures have all stainless steel construction. For sizes larger than 2 in., installation of two traps in parallel is recommended by the manufacturers. The impulse trap is ordinarily non-air binding as small amounts of air would ordinarily be discharged through the permanently open orifice; however, where large amounts of air must be eliminated at frequent intervals (such as blast coils and unit heaters controlled by "on and off" automatic valves), supplementary provision for eliminating air in the form of thermostatic bypasses is required. These traps are particularly suitable for installation on trains, ships, etc., where space is always at a premium and as their operation is little affected by motion.—F.C.J.

THREE MAIN CLASSES OF STEAM TRAPS

In reply to "F.S." on his question published in the December HPAC regarding steam traps and their application, I present the following discussion:

The steam trap is a device for removing water of condensation from a pipe or some piece of equipment without allowing steam to escape. Some traps are designed for elimination of air from the piping system as well as condensate. There are numerous types of traps but they come under three main classifications: (1) thermostatic, (2) mechanical and (3) thermodynamic or orifice.

Under the heading of thermostatic there are two main types. The most common is the one that depends upon the variation in expansion of the metals in the bellows or thermostatic element. The other type depends upon the expansion of the bellows by a volatile liquid which is sealed in the bellows. On an increase in temperature this liquid flashes to a gas or vapor. This produces a pressure inside the bellows, causing it to expand and close the valve.

Thermostatic traps of the first type are satisfactory for use with air preheaters, steam radiators, steam tables, cooking kettles (small size), and similar services where the steam pressure is low, condensate load not too great, and temperature range is small.

Thermostatic traps of the second type are required on heating equipment in marine installations and will stand higher pressures and greater temperature ranges. This type of trap should not be used on preheaters as there is danger of the trap holding the condensate in the line long enough to allow it to freeze if it is in an exposed place.

Under the heading of Mechanical we have (1) thermostatic combinations, (2) ball float (including return traps used in vacuum heating systems), (3) open bucket and (4) inverted bucket in various arrangements. Of thermostatic combinations, float and thermostatic is the most common and widely used in heating.

Float and thermostatic traps are well adapted for use with air preheaters, air reheaters, unit heaters, kitchen equipment, and blast coils. These traps are designed to release both condensate and air from the equipment and piping. The float and thermostatic trap is a good trap for dripping the end of the steam main or a steam riser, and is preferred for unit heaters.

Ball float traps have a hollow ball float that rides on the condensate as it flows into the trap. As the condensate rises, the float rises until it opens the discharge orifice through a system of levers. The condensate is then discharged by the steam pressure on the steam side of the trap. These traps can be used for continuous discharge service. When the steam is first turned on, these traps must be air vented by hand. They are suitable for handling larger quantities of condensate, and can be used on hot water generators when heated with a steam coil and other similar services.

The principle upon which the open bucket trap operates is as follows:

The water of condensation flows into the trap and fills the space between the bucket and body of the trap, causing the bucket to float and rise and thus closing the outlet. When the water reaches the top of the bucket, it overflows into the bucket. This causes the bucket to fall and open the discharge, allowing the steam pressure to force the condensate out until the bucket is emptied. Then the cycle begins again; thus, the discharge is intermittent. These traps are built in a number of different styles, some of which have automatic air venting apparatus. These traps are designed for a wide range of pressure and will handle large quantities of condensate. They are used in power piping and large central heating plants and similar heavy services.

Inverted bucket traps also discharge intermittently but they operate differently. The body is always

Read Equipment Developments in every issue!

QUESTION OF THE MONTH

YOU ARE invited to submit a heating, piping, or air conditioning question for publication here. You are also invited to submit answers to previously-published questions from others. Those published are paid for at regular rates. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

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filled with water. The steam enters the trap under the inverted bucket, causing it to float. This closes the discharge, allowing the trap to fill with water until it forces all steam and air from the bucket. The bucket then sinks, opens the discharge, and steam forces out condensate. No air relief valves are necessary as this trap automatically vents the air through the top of the bucket. These traps are very popular and can be used for a variety of services satisfactorily. They are excellent for air reheaters, large steam kettles, large steam coils, steam processing equipment, hot water storage heaters, hospital and laundry equipment, and all similar services. They can be obtained for both high and low pressure and have capacities to handle large quantities of condensate.

Orifice Type Traps

Thermodynamic or orifice type traps are used mainly in high pressure steam services and in power piping work. Under this classification we have the impulse trap. The operation of the impulse trap depends on condensate flashback and a control cylinder and two orifices, one fixed and one movable. When there is condensate in the trap, the pressure is greater under the valve than in the control chamber. This lifts the valve from its discharge orifice and the condensate is forced out. Part of the condensate flashes back to steam in the control chamber and produces enough pressure to close the discharge orifice. This trap is very convenient to use as it is very compact and very simple in design. It may be used on air reheaters, steam kettles, sterilizers, laundry equipment, hot water storage heaters, and similar processing equipment.

An impulse trap should never be used on air preheaters and unit heaters where there is the slightest possibility of freezing.

How Trap Is Installed Is Important

There is more to getting good service out of a trap than just the selection of the trap. It is equally important to locate it in the proper place (1) so that the condensate reaches the trap, (2) so that it is easily accessible for inspection and repair, (3) so that it is protected by a dirt strainer, (4) so that it does not have to discharge against an excessive back pressure or head, (5) so that it is not overloaded, (6) so that the inlet and outlet are properly connected in relation to flow, and (7) so that necessary cooling leg is provided ahead of the trap.

A bypass should be provided where uninterrupted service is required. A check valve should be installed between the trap and any discharge header and the trap must have greater discharge pressure than any such header.

Remember the physical size of a trap has very little to do with its capacity. This is governed by the pressure differential across the trap orifice or discharge outlet.—S.R.H.

Cost and Capacity Data for Hospital Air Conditioning

According to Gerald C. Dittman, mechanical engineer, Schmidt, Garden, & Erikson, architects and engineers, in a talk on hospital air conditioning at a recent meeting of the Chicago section of the American Society of Refrigerating Engineers, the air conditioning installation cost (including heating) for a five story hospital addition in Indiana ran $950 per ton of refrigerating capacity. The conditioned area comprises 21,600 sq ft of floor space, and the cost was equivalent to $4.80 per sq ft, or to $7.70 per cfm of air. About one-third of these cost figures should be charged to heating, and two-thirds to air conditioning.

The addition is of brick construction, no insulation, double glass windows. Design conditions were 80 F dry bulb and 55 percent relative humidity, with 95 F dry bulb and 75 F wet bulb outdoors. The square feet of floor area served per ton of refrigeration is somewhat under 200 sq ft, according to Mr. Dittman.

Air conditioned patients' rooms, operating rooms, and x-ray rooms are included in this addition.

For a group of 10 operating rooms on the top floor of a Chicago hospital (the group having three exposures, and the duct system being divided into three zones), the air conditioning installation cost ran $1300 per ton. The 10 rooms have a total floor area of 5200 sq ft. The cost for air conditioning was equivalent to $12.80 per sq ft of floor space, and slightly over 100 sq ft of floor area is served per ton of refrigeration. Much of the air conditioning cost in this case was due to construction of the required equipment pent-house, changes in the building, and ventilation to meet city code requirements.

This was an existing building, of course, and the work was put in to meet city code requirements. The ventilation alone, to meet code requirements, cost $9.50 per sq ft and the air conditioning added $3.30 per sq ft, making the total of $12.80 per sq ft for the ventilation and air conditioning with 100 percent outdoor air.

Design conditions for this hospital were the same as for the Indiana hospital mentioned above.

In the course of his talk, Mr. Dittman said that he believed it was "practically essential" to exhaust air from operating rooms at floor level, because anesthetic gases are heavier than air; he stated that exhaust at the ceiling of such rooms has proved "most unsatisfactory."

He stressed throughout his address the need for intelligent operation of the air conditioning and other mechanical services in hospitals.

Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

Measurement of Heat Output of a One Square Foot Panel

By R. S. Leigh*, Waterbury, Conn., and R. G. Vanderweil**, New York, N. Y.

SUMMARY — The output of a test panel was measured when the panel was located in various positions corresponding to location of panels in radiant heating systems. In comparing the measured output with the output which would be predicted from a chart prepared by the author, it was found that the test and chart values were within 10 percent of agreement.

Introduction

THE object of this experiment was to obtain test confirmation of a simple graphical method for determining the heat output in Btu per (hour) (sq ft) from a heated panel of a certain surface temperature to a room of certain temperature. The graphical method, first proposed by Giesecke[1], as adapted for use by Vanderweil[2], presupposed the use of a mean effective temperature (MET). This arithmetic average of the air temperature t_a and the effective average of all the surface temperatures t_s, when used as the receiving temperature, should give results sufficiently accurate for use in the design of radiant heating systems. Due to the inherent flexibility of water temperature in radiant heating systems, and due to the economic undesirability of excessive calculation, it is apparently sufficient for the engineer to be able to predict results within 10 percent.

Such a method is indicated graphically for floor panels, in Fig. 1. From this type of chart, the heated panel surface temperature, for a given room temperature, gives a direct reading of heat output, Btu per (hour) (sq ft).

The test was concerned with measuring the output of a heated panel in a floor and ceiling position and in a room of various air and room surface temperatures. Comparison has been made using 111 tests with the panel in a floor position and 50 tests in a ceiling position. By comparing the test results with those obtained from the design charts it was found that the latter were close enough to be used for practical design.

Results

At inputs varying from 27 to 103 Btu per sq ft for ceilings and from

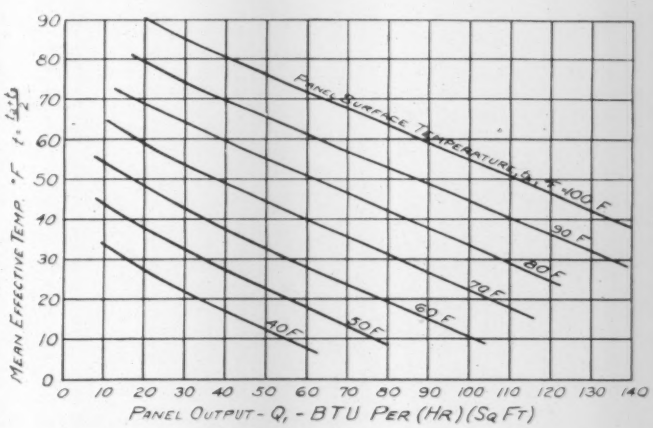
MEAN EFFECTIVE TEMP. °F $t_a + \frac{t_s}{2}$
PANEL SURFACE TEMPERATURE, °F
100 F
90 F
80 F
70 F
60 F
50 F
40 F
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
PANEL OUTPUT - Q_1 - BTU PER (HR) (SQ FT)

Fig. 1 — Floor panel output chart

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* Project Engineer, Chase Brass & Copper Co.

** Consulting Engineer, Slocum & Fuller.

[1] Radiant Heating and Cooling. How to Figure Total Heat Delivered by Panel, by F. E. Giesecke. (*Heating, Piping & Air Conditioning*, August 1940, p. 484.)

[2] Heat Flow in Panel Heated Rooms, by R. G. Vanderweil. (*Heating & Ventilating*, October 1945, p. 102.)

Presented at the 54th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, New York, N. Y., February, 1948.

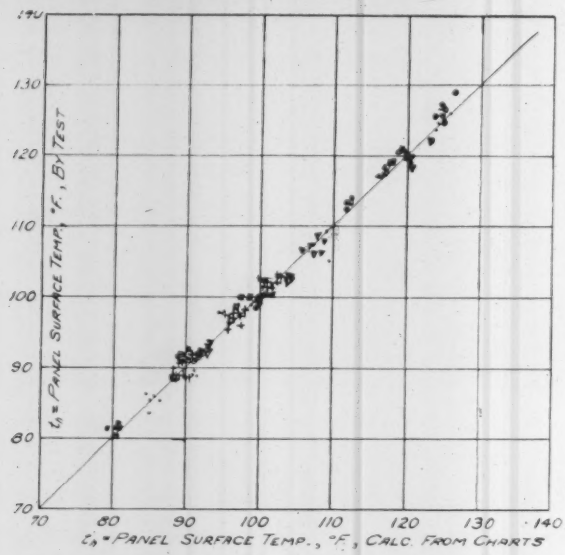

Fig. 2—Comparison of temperatures

· Panel As Ceiling, At Window
○ Panel As Ceiling, At Wall
+ Panel As Floor, At Window
□ Panel As Floor, At Wall
▽ Panel As Floor, At Center Of Room

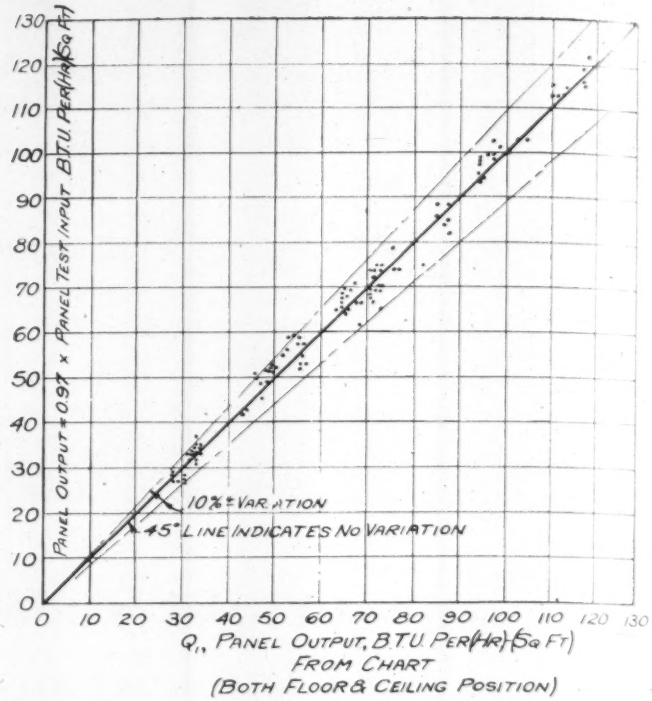
Panel Output + 0.97 × Panel Test Input, BTU Per (Hr) (Sq Ft)
10% ± Variation
45° Line Indicates No Variation
Q_1, Panel Output, BTU Per (Hr) (Sq Ft) From Chart (Both Floor & Ceiling Position)

Fig. 3—Deviation of measured output from values given in charts

32 to 125 Btu per sq ft for floors and with the mean effective room temperature varying from 62 F to 73 F with ceiling panels and from 57 F to 78 F with floor panels, the measured surface temperature at a steady state condition varied no more than three degrees from the surface temperature determined from floor or ceiling charts, such as shown in Fig. 1. The comparison of surface temperatures obtained by test with those determined by chart is shown in Fig. 2. It may be seen that the deviations from the 45 deg line indicating full agreement of chart and test are small. The measured heat output was compared with the results obtained from the charts in Fig. 3, which indicate again small deviations of 10 percent or less. The heat output computed from the charts deviated, on the average, ± 3 percent from the test readings.

Under normal test conditions and procedures this could be considered a reasonable correlation. The individual test instrument accuracy was about 1 percent, and more important errors could have occurred due to panel surface temperature inertia caused primarily by uncontrollable air temperature changes. Form factors used were merely reasonable approximations, but of sufficient accuracy for this test. When deal-

Table 1—Test Temperature and Output Ceiling Panel Near Window

		Time			
		12:15 PM	12:30 PM	12:45 PM	1:00 PM
Avg. Air temp. (F)[a]	t_a	66.1	67.6	68.0	68.0
Avg. Wall temp. (F)[b]	t_w	63.8	64.4	64.4	64.0
Avg. Glass temp. (F)[b]	t_g	58.0	59.7	59.0	59.0
Avg. Floor temp. (F)[a]	t_f	65.7	66.6	66.3	66.0
Form factor × t_g	0.5 t_g	29.0	29.8	29.5	29.5
Form factor × t_f	0.3 t_f	19.7	20.0	19.9	19.8
Form factor × t_w	0.2 t_w	12.8	12.9	12.9	12.8
Effective Surface temp. (F) (t_s=0.5 t_g+0.3 t_f+0.2 t_w)	t_s	61.5	62.7	62.3	62.1
MET (F) = $\frac{t_a + t_s}{2}$	MET	63.8	65.1	65.1	65.0
Avg. Panel Surf. temp. (F)[c]	t_h	85.7	86.0	86.0	86.0
Measured Panel Output Btu per (Hr) (Sq Ft)[d]	Q_1	26.7	28.4	28.6	28.4
Calc. Panel Surf. temp. (F)	t_h^1	83.0	85.5	85.5	85.0
t_h − MET	—	21.9	20.9	20.9	21.0
Panel Surface Conductance Btu per (Hr) (Sq Ft) (F Deg) = $\frac{Q_1}{t_h - \text{MET}}$	h_o	1.22	1.36	1.37	1.35

[a] Avg. of 2 readings [b] Avg. of 4 readings [c] Avg. of 7 readings
[d] See text

Table 2—Test Temperature and Output Floor Panel Near Window

		Time			
		11:20 AM	11:35 AM	11:50 AM	12:05 PM
Avg. Air temp. (F)[a]	t_a	76.0	75.3	75.6	71.0
Avg. Wall temp. (F)[b]	t_w	71.3	71.0	70.7	71.0
Avg. Glass temp. (F)[b]	t_g	70.0	70.7	70.0	68.4
Avg. Ceiling temp. (F)[a]	t_c	77.0	77.0	77.0	75.0
Form factor × t_g	0.4 t_g	28.0	28.3	28.0	27.4
Form factor × t_c	0.4 t_c	30.8	30.8	30.8	30.0
Form factor × t_w	0.2 t_w	14.3	14.2	14.2	14.2
Effective Surface temp. (F) (t_s=0.4 t_g+0.4 t_c+0.2 t_w)	t_s	73.1	73.3	73.0	71.6
MET (F) = $\frac{t_a + t_s}{2}$	MET	74.5	74.3	74.3	71.3
Avg. Panel Surf. temp. (F)[c]	t_h	91.0	91.7	91.7	90.0
Measured Panel Output Btu per (Hr) (Sq Ft)[d]	Q_1	32.7	33.8	32.3	32.7
Calc. Panel Surf. temp. (F)	t_h^1	91.0	91.0	90.5	88.5
t_h − MET	—	16.5	17.4	17.4	18.7
Panel Surface Conductance Btu per (Hr) (Sq Ft) (F Deg) = $\frac{Q_1}{t_h - \text{MET}}$	h_o	1.98	1.94	1.86	1.75

[a] Avg. of 2 readings [b] Avg. of 4 readings [c] Avg. of 7 readings
[d] See text

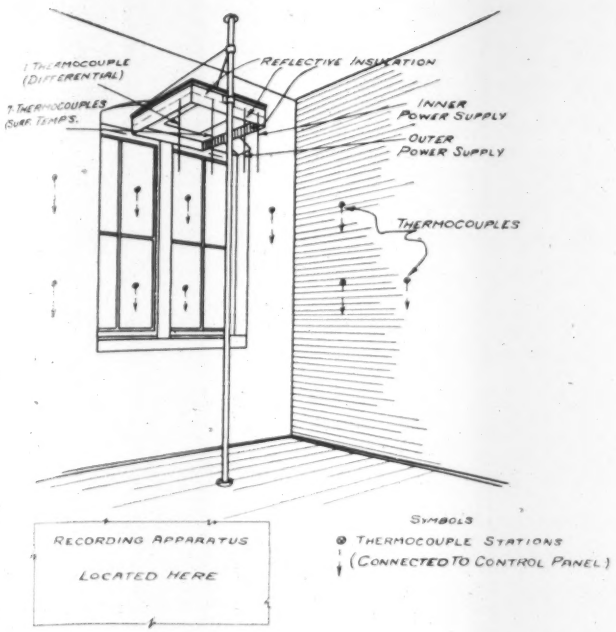

Fig. 4—Ceiling panel test near glass

ing with small temperature differences between the heated surface and the room, other causes of discrepancy occur, and thus, this test and the graphical method is limited in scope to temperature differences between the heated panel and the room on the order of 10 deg or more.

Equipment

The test panel used is shown in Figs. 4 and 5, its heating system and thermocouple attachment in Fig. 6. A cement panel ¼ in. thick was used in order to reduce the lag of the panel to the point where equilibrium conditions could be reached in less than one hour, from a cold condition. The inner test panel of an area of one square foot as well as the protective outer panel were attached to a 1 in. sugar cane fiber board as indicated in Fig. 6, and 3 in. of rock wool insulation was applied to the back of the board. The losses from the back of the panel were calculated and roughly checked and found to be around 3 percent of the input. In all calculations the actual measured input multiplied by 0.97 was used as the output from the surface of the inner unit test panel. Any variation in temperature between the inner unit test panel and the surrounding panel could be measured by means of a differential thermocouple consisting of eight chromel-alumel thermocouples in series, and the input to the surrounding panel was adjusted during tests to maintain zero differential. Surface temperature was measured by five iron-constantan thermocouples buried close to the surface of the cement, and in addition, two thermocouples were attached to the surface with glue. The position and type of attachment did not seem to influence the test reading materially. The use of tape over the thermocouple, however, was tried and caused variations of one to three degrees, and was not continued. Two of the couples were located above the wire, the others between wires, to obtain average surface temperatures. Electrical input (a-c) was varied by means of variable resistors and

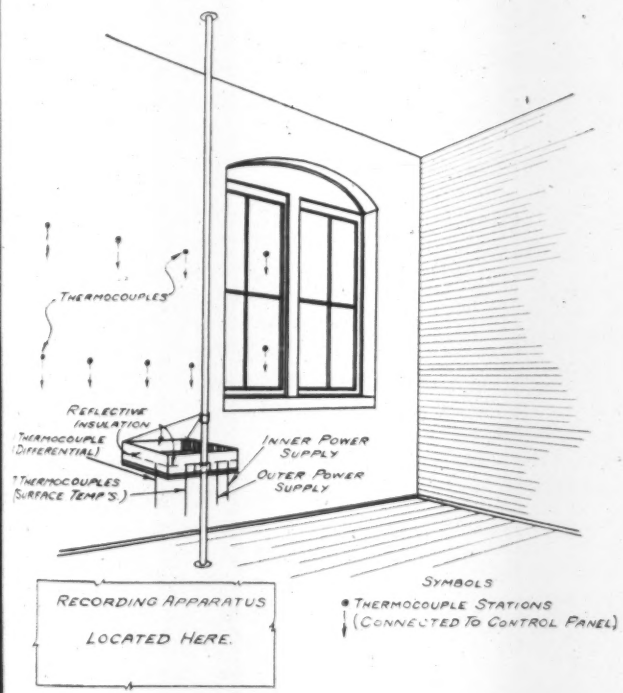

Fig. 5—Floor panel test near wall

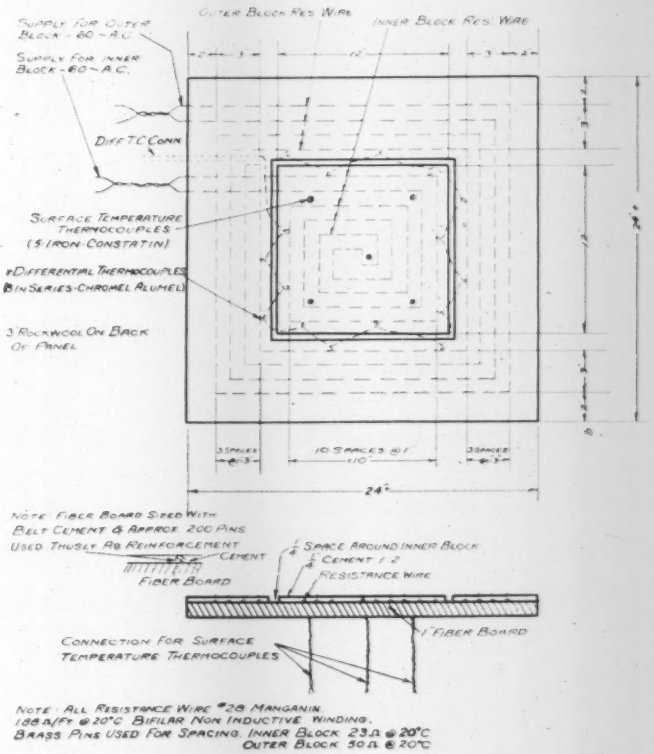
SUPPLY FOR OUTER BLOCK - 60 ~ A.C.
SUPPLY FOR INNER BLOCK - 60 ~ A.C.
OUTER BLOCK RES. WIRE
INNER BLOCK RES. WIRE
DIFF T.C. CONN.
SURFACE TEMPERATURE THERMOCOUPLES (5 IRON-CONSTATIN)
8 DIFFERENTIAL THERMOCOUPLES (8 IN SERIES-CHROMEL ALUMEL)
3 ROCKWOOL ON BACK OF PANEL
24"
NOTE: FIBER BOARD SIZED WITH BELT CEMENT & APPROX. 200 PINS USED THUSLY AS REINFORCEMENT
CEMENT
FIBER BOARD
SPACE AROUND INNER BLOCK CEMENT 1/2 RESISTANCE WIRE
1" FIBER BOARD
CONNECTION FOR SURFACE TEMPERATURE THERMOCOUPLES
NOTE: ALL RESISTANCE WIRE #28 MANGANIN 188 Ω/FT. @ 20°C BIFILAR NON INDUCTIVE WINDING. BRASS PINS USED FOR SPACING. INNER BLOCK 23 Ω @ 20°C OUTER BLOCK 30 Ω @ 20°C

Fig. 6—*Right*, Lightweight test block

measured by means of a voltmeter and ammeter, which were accurate within 0.75 percent.

All room temperatures were measured with iron-constantan thermocouples. Readings were obtained with a potentiometer tested to be accurate to within 0.01 mv. The reference junction temperature was determined by a thermocouple and a clinical thermometer (tested by the State of Connecticut to be accurate within 0.1 deg) placed alongside the thermocouple under the tongue.

Test Procedure

The panel was first set up as a ceiling next to the window as shown in Fig. 4. Air temperature, t_a (2 points); wall temperature, t_w (4 points); window glass temperature, t_g (4 points); floor temperature, t_f (2 points); panel surface temperature, t_h (7 points); and electrical input were measured. To calculate mean surface temperature, t_s, form factors were assigned by estimate, as indicated in Table 1.

The panel was then moved from the window to the wall and a similar set of readings followed. The panel was then reversed, still in a horizontal position but with the surface up, as a floor, and tests were run for locations next to the window (Table 2), next to the wall (Fig. 5) and in the center of the room.

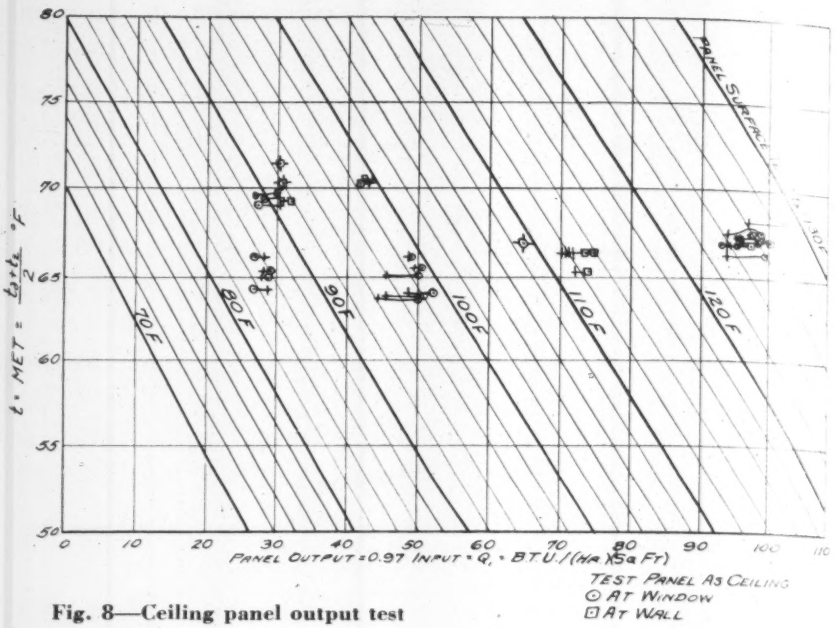

Fig. 8—Ceiling panel output test

Curves

The tests were calculated, then plotted as shown in Figs. 2, 3, 7 and 8. Fig. 2 indicates the relationship between the actual surface temperature as read from seven thermocouples, and that surface temperature for the test conditions of output and mean effective room temperature, as determined from the charts.

Fig. 3 compares the computed and tested panel output. The deviation of the tests from the charts for both ceilings and floors were of equal magnitude, and floor as well as ceiling tests are plotted in Fig. 3. Figs. 7 and 8 show more specifically the deviation of the individual test points from the graphs. Fig. 7 is an enlargement of Fig. 1; Fig. 8 is an enlargement of a similar graph showing the ceiling output.

Depending on panel location the test results were indicated by circles, squares or triangles and the calculated heat output by crosses. The straight lines connecting test and calculated results indicate their deviation. It may be seen that the average deviations of the test panel output from the chart result in ± 3 percent. The average deviation in ceiling panels (Fig. 8) is the same. In both figures the hourly output of 1 sq ft of panel area (Q_1) is plotted against the mean effective temperature, MET $= \frac{t_a + t_s}{2}$

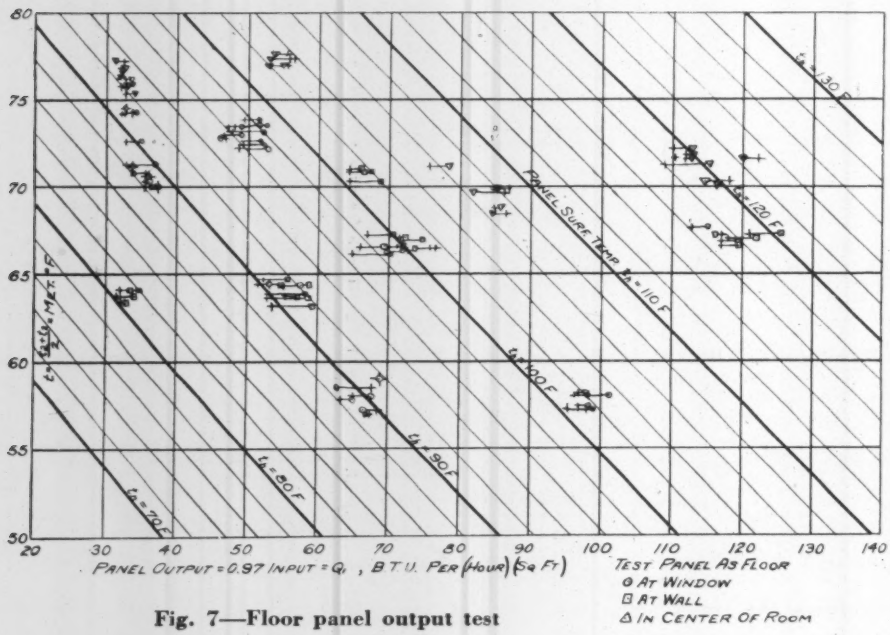
PANEL SURF. TEMP. t_h = 130 F
PANEL SURF. TEMP. t_h = 120 F
PANEL SURF. TEMP. t_h = 110 F
t_h = 100 F
t_h = 90 F
t_h = 80 F
t_h = 70 F
PANEL OUTPUT = 0.97 INPUT = Q, B.T.U. PER (HOUR) (Sq Ft)
TEST PANEL AS FLOOR
⊙ AT WINDOW
⊡ AT WALL
△ IN CENTER OF ROOM

Fig. 7—Floor panel output test

Conclusion

There were 161 tests performed within the range of common room temperatures and with panel outputs varied from 27 to 125 Btu per sq ft (panel) (hour) indicated close agreement between test readings and panel design charts for floor and ceiling systems such as shown in Fig. 1. The maximum deviation from the predicted panel output was 10 percent, the average deviation was about 3 percent. The magnitude of this deviation was not related to the position of the panel, whether ceiling or floor, nor to the proximity of cold glass surfaces.

An Improved Test Method for Rating Air Filters

By R. S. Farr,* W. N. Pauley,** and K. A. Crismon, M. D.,† Los Angeles, Calif.

SUMMARY—The authors list the requirements of an adequate air filter testing method and summarize what a test code should include to meet these requirements. In the belief that the first approach to developing an adequate test code lies in eliminating those variables in air filter testing other than test dusts, the authors have developed and described a test duct, dust feeder and dust sampler which allows the test dust to be evenly distributed within ±5 percent, and the air velocity within ±15 to 20 percent. Simultaneous dust sampling is used. It is recommended that complete performance curves or families of curves be furnished designers as a basis for proper filter selection.

EVER since the value of air filtration to industry has been recognized there has been a great difference of opinion as to correct and satisfactory methods of evaluating air filter performance. Independent laboratories, filter manufacturers, and even some large air filter users have established their own test procedures for comparing and rating air filter performance. Most of these adapted methods have helped to advance the science and art of air filter testing by offering new techniques and ideas. All have been valuable in that they have led to an accumulation of test data which have revealed many admitted faults, and have pointed the way toward better and more reliable methods.

In the introduction to a paper in 1933, S. R. Lewis[1], in a capable manner, covered the necessity for a method of rating air filters by means of some nonproprietary scheme, of reasonably consistent performance, within the dust ranges commonly encountered in ventilation. Mr. Lewis' sound and fundamental reasoning applies today just as definitely as it did in 1933. The only difference today is that the science of air filtration and the science and art of air filter testing have advanced to the point where much of what was acceptable then is now unacceptable.

Requirements of Any Testing Method

In an approach to the problem of improvement of the science and technique of air filter testing, it is necessary to have a clear understanding of what the requirements of an adequate air filter testing method should be. These requirements are:

1. The test method must yield data which enable a true comparison to be made of various types of air filters operating under various conditions.
2. The method must furnish sufficient data to give an indication of the expected performance and life of air filters operating under various field conditions. The results of the tests must permit interpretation to the extent that the proper and economical filter choice can be made for any specific problem.
3. The method must be precise in procedure and technique so that: *(a)* repeated tests show consistent results; *(b)* operation of the test is entirely a matter of routine technique devoid of any element of choice of procedure.
4. The test method must be as devoid as possible of operating variables. Those variables which do exist should be recognized and properly evaluated, accounted for, and shown in the record data of the test.
5. The test method should facilitate rapid testing when using various types of air filters operating under various test conditions.
6. The test method should be an instrument to provide necessary data for basic improvement of air filter designs.

After making thousands of test runs with test apparatus similar to most of that equipment in current use or proposed, it is the opinion of the authors that to meet the requirements outlined, an adequate air filter test code should specify the following:

1. A test duct of standard construction.
2. A standard method for measuring air.
3. A standard method for feeding dust.
4. The air velocity distribution at the filter face within narrow specified limits.
5. The dust distribution at the filter face within narrow specified limits.
6. Simultaneous sampling of the upstream dirty air and the downstream clean air so that the effect of any variables occurring during the sampling will appear in the factors obtained to compute efficiency.
7. Kinds of test dust to be used. More than one type of test dust should be specified in order to approximate various operating conditions found in practice. Test dusts should be of particle size and specific gravity approxi-

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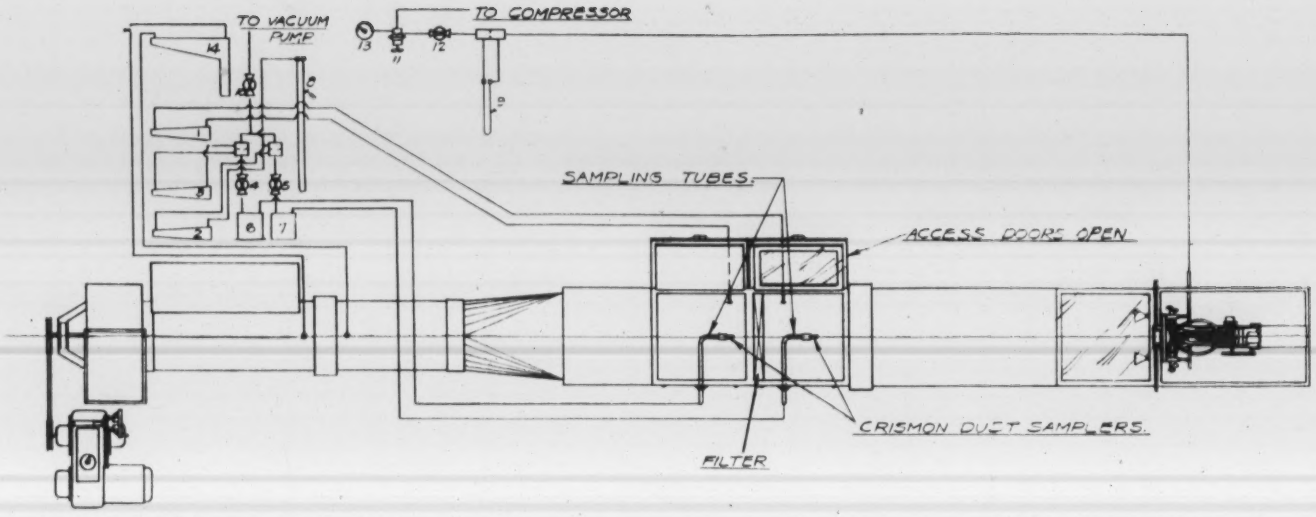
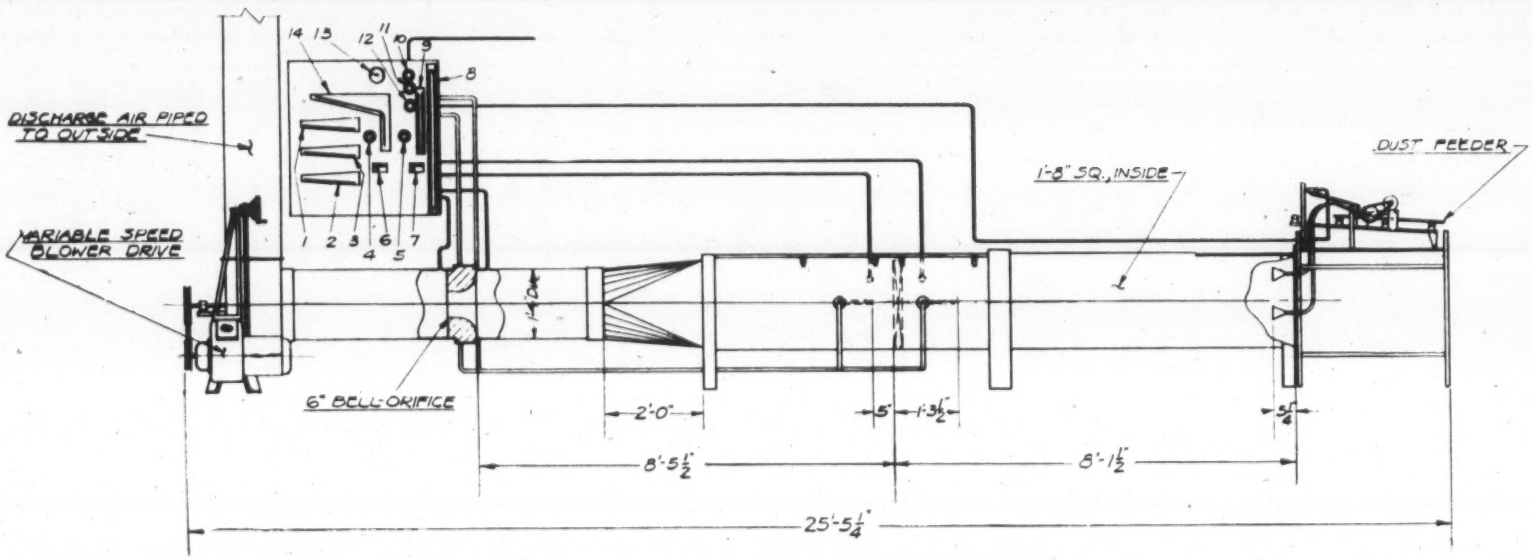
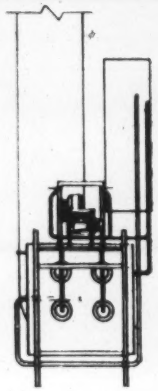
†Director of Research, Farr Co.
[1]Exponent numerals refer to Bibliography.
Presented at the 54th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, New York, N. Y., February 1948.



PLAN VIEW
(PIPING SHOWN SCHEMATICALLY)



SIDE VIEW



END VIEW
(BLOWER MOTOR EXCLUDED)

Fig. 1—Assembly—Far-air test apparatus

1—Inclined draft gage
2—Inclined draft gage
3—Inclined draft gage
4—Valve
5—Valve
6—Gas meter
7—Gas meter
8—30 In. manometer
9—12 In. manometer
10—Valve
11—Pressure regulato
12—Valve
14—Inclined, vertical, draft gage

mating dusts found in operating conditions. Generally speaking, dusts should be of a particle size much smaller than those used at the present time in order to show differences between different types of equipment. All test dusts should be procured from a single established standard source in order to preserve uniformity of the test results.

8. Test codes to be used. Test codes should be specified for air filter rating by both a weight sample evaluation method and by a discoloration sample light penetration method. With slight alteration the same test set should be adaptable to both methods.

It is not the purpose of this paper to discuss in detail the various faults of air filter testing methods in current use. It is enough to mention that all of the currently used testing methods with which the authors are familiar, including the 1933 ASHVE Code[5], the method proposed by Rowley and Jordan[2], the proposed code of the Air Filter Institute, and various modifications of these codes used by some air filter manufacturers and large air filter users, have the following basic faults:

1. The air velocity distribution at the test filter face is not uniform.
2. The dust distribution at the test filter face is not uniform.
3. The dust sampling devices are uncertain. They are affected by variations in dust concentration, by moisture content of the air and by remote location of the device in the test duct.
4. The test dusts used are not typical of those found in the field, are generally far too coarse in nature, tend to agglomerate a great deal, and are not readily reproduced.

Few will take issue with the statement that it has long been recognized that air filter testing methods currently in use do not satisfy the requirements of an adequate air filter test code. This fact has been recognized by the ASHVE Research Technical Advisory Committee on Air Cleaning. At the present time a program is actively under way at the ASHVE Research Laboratory to develop acceptable testing and rating methods for air cleaning devices that will be acceptable as a standard code. These studies are being supported both by organizations in the air cleaning industry and some of the principal air filter users.

A good deal of test work, discussion, and differences of opinion on air filter testing during the past few years have had to do with the type of test dust to be used. With the present testing methods it is impossible to evaluate the advantages and disadvantages of any test dust. It has long been the opinion of the authors that the first requirements were to develop reliable test apparatus and an acceptable test method. With this thought in mind, the authors attempted to eliminate or greatly minimize existing variables. The project is far from complete. It is believed, however, that some variables have been minimized to a point where they are acceptable. It is further believed that, if interested laboratories will incorporate in their present test methods the devices and procedures that have led to these improvements, a coordinated investigation of still unsolved problems can be undertaken to expedite and hasten the development of an acceptable air filter test code. It is with this anticipation that all phases of the equipment are described in detail.

Test Dust

The test dust used during the development of most of the equipment to be described is commonly known as Army Standardized Fine Air Cleaner Test Dust. This is a special dust processed to definite specifications by the AC Spark Plug Division of General Motors Corp. and is available from the manufacturer. It is the test dust most commonly specified by the armed services during the last war. Most major air filter manufacturers have an intimate knowledge of its properties. The analysis of this dust is given in Table 1. This dust is of much smaller particle size than most test dusts in current use. Because of its chemical properties and composition, it has only a slight tendency to agglomerate, and is only slightly affected by atmospheric moisture. It has one drawback—its specific gravity is quite high. The authors believe, however, that its good points make it much more desirable than other proposed dusts. In any case, for the problem at hand, it was not necessary to have a perfect test dust.

Table 1—Dust Analysis—Army Standardized Fine Air Cleaner Test Dust

Specific Gravity—2.5	
Chemical	Percent
Ignition Loss	2.68
SiO_2	68.47
Fe_2O_3	4.58
Al_2O_3	15.98
CaO	2.91
MgO	0.77
Total Alkalies as Na_2O	4.61
Particle Size by Weight	**Percent**
Less than 2½ to 3 Microns	10
0 to 5 Microns	39 ± 2
5 to 10 Microns	18 ± 3
10 to 20 Microns	16 ± 3
20 to 40 Microns	18 ± 3
40 to 80 Microns	9 ± 3
Through 200 Mesh Screen	100

During most of this experimental test work, dust was fed at the rate of 0.28 grams per 1000 cu ft of air flowing through the test filters. In order to obtain test results in a reasonable length of time, the test dust concentration must be much greater than that normally found in nature. Most air filter testing laboratories have found that 0.35 grams per 1000 cu ft of air flowing through the test filter does not appreciably impair the filter performance provided test runs no longer than two hours are made and provided there is a *rest* interval of one hour between tests. Rowley and Jordan[2] have claimed that concentrations considerably greater than this may be used without deleterious effect to the test.

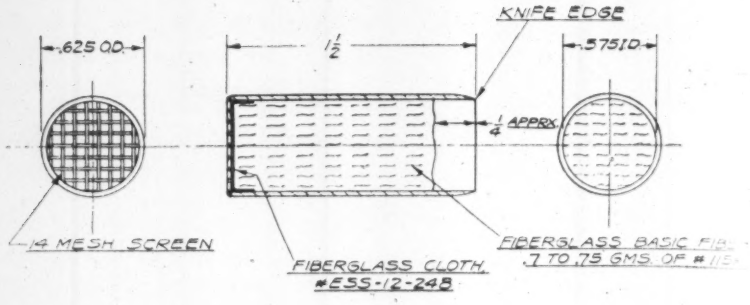
Test Apparatus

The general layout of the test duct used is shown in Fig. 1. The final arrangement of this test duct was devised after the authors had tried several arrangements proposed in the past as well as several new arrangements. The duct was designed for testing 20 in. x 20 in. (nominal size) air filter panels. In some laboratories a testing panel as small as 6 in. x 6 in. is considered satisfactory. It has been the authors' experience, however, that small test ducts exaggerate the influence of variables involved. Also, some air filter manufacturers claim that small sections of their filters are not adequately representative of the full sized unit. As the 20 in. x 20 in. panel is of the most common size, the test duct was constructed to suit this size. The inside of the

test duct was smooth and free from any projections or roughness that might have modified air flow or collected dust.

The nozzle used for air flow measurement was a 6 in. bell-orifice nozzle constructed in accordance with the specifications of the *ASME* Power Test Codes 19.5.4-1940 titled *Flow Measurement 1940*. Perforated plate diffusers such as described by D. D. Wile[3] were placed in the duct on either side of the nozzle. The blower was driven by a variable speed drive so that any air flow requirement could be obtained. The discharge air was piped to the outside of the building so that any dust it contained would not be recirculated to the air intake. The laboratory room was kept clean and the air entering it was filtered.

The arrangement of equipment and instruments is shown schematically in Fig. 1 and the instrument panel board is shown in Fig. 2. The usual static taps are placed on either side of the bell-orifice in order to measure air flow, and on either side of the test filter to measure resistance to air flow through the filter. A vacuum pump first draws air through the dust samplers then through positive displacement recording gas meters, and then through calibrated plate orifices. The pressure drop across these orifices is measured by static draft gages. The air flow in the sampler lines is held to 0.95 times the air flow velocity in the test duct[4]. This rate of air flow is regulated by valves installed on the inlet side of the gas meters. As the samplers accumulate dust, the system resistance progressively increases indicating progressive decrease of sampler air flow. The resistance of the upstream or dirty air sampler usually increases at a much greater rate than the downstream or clean air sampler. This resistance increase requires the operator to watch the draft gages which measure resistance across the plate orifices, and to adjust frequently the control valves so as to maintain a constant air sampling rate. The gas meters are included to give a volumetric check of the total cubic feet of air sampled and to provide data for correction of the difference between the upstream and downstream sampler collections, if found necessary. With reasonable attention to the gages, however, it is fairly easy to draw test air samples within less than plus or minus one percent of each other throughout a series of test runs. In addition to the instruments already mentioned, a 30 in. mercury manometer is included to measure the vacuum maintained for the purpose of drawing the air through the samplers. At a velocity of 410 fpm through the samplers a vacuum of 18 in. of mercury is required. Dry and wet bulb temperature readings and the barometric pressure reading of the laboratory room air are recorded at the beginning of each test run.



Casing material—⅝ O.D. x 23 Ga. (stubs) seamless brass tubing

Fig. 3—Assembly—Crismon dust sampler

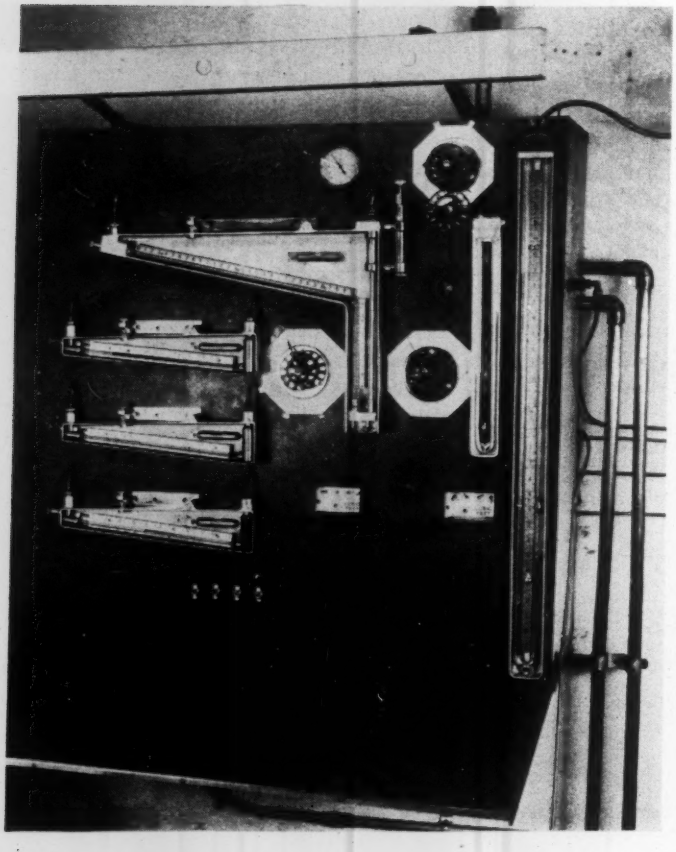


Fig. 2—View of instrument panel

Dust Samplers

Fig. 1 also shows dust samplers in position to take simultaneous samples from the upstream and downstream sides of the test filter. As stated earlier simultaneous sam-

pling is necessary to insure that the effect of any variables occurring during the sampling will appear in the factors obtained to compute efficiency. When single samples[1,2,5] are taken and the differences in dust concentration are measured both with and without a test filter in the duct, the sampling is liable to so many errors that the results may be seriously questioned. In 1938 R. S. Dill[6] proposed simultaneous sampling for application to a light penetration method of comparing the performance of air filters. Simultaneous sampling has since been extensively applied to a weight method of rating air filters.

The upstream sampling tube was located about 14 in. in front of the filter holding frame, and the downstream sampling tube was about 6 in. behind. Both tubes were located in the geometric center of the test duct. Rubber couplings were fastened on the end of the sampling tubes and into these couplings were inserted Crismon dust samplers.

Details of the Crismon dust sampler are shown in Fig. 3. All of the materials making up these samplers are nonhygroscopic. The materials for the sampler pack are glass cloth (Fiberglas No. ESS-12-248) and glass wool (Fiberglas Basic Fiber No. 115K). The samplers may be handled more or less incautiously, and need only to be wiped with an ether or alcohol moistened cloth to remove deposited finger stains before weighing. Repeated tests have been conducted to determine the amount of the test dust passing through these samplers. A high powered microscope has shown that some ultra fine dust particles can pass through. The magnitude of this ultra fine dust escaping the samplers is so small, however, that its weight is less than one tenth of a milligram after an hour test run with a collection of more than 0.02 grams of dust. A tenth of a milligram is within the accuracy of most sample weighings. For all practical purposes it can be said that this sampler is nearly an absolute filter. Since this sampler is not affected by atmospheric moisture, a vast amount of time has been saved in sample weighing; the testing process has been remarkably accelerated and, more important, the test results have been much more consistent and reliable.

Dust Feeder

Details of the dust feeder developed by the authors are shown in Fig. 4. Before designing this particular dust feeder, hundreds of test runs were made with many and various types and modifications of dust feeders. Agitated dust chambers, modified elutriators, band type feeders, plate type feeders on both vertical and horizontal axes, and others were tried. Many methods and schemes were improvised to distribute the dust in the test duct including single and multiple orifices of various sizes, conical and plate impingement baffles, revolving and stationary dust nozzles of various shapes from cones to *fish-tails*, directed air jets and many others. The degree of satisfaction obtained by various combinations of the

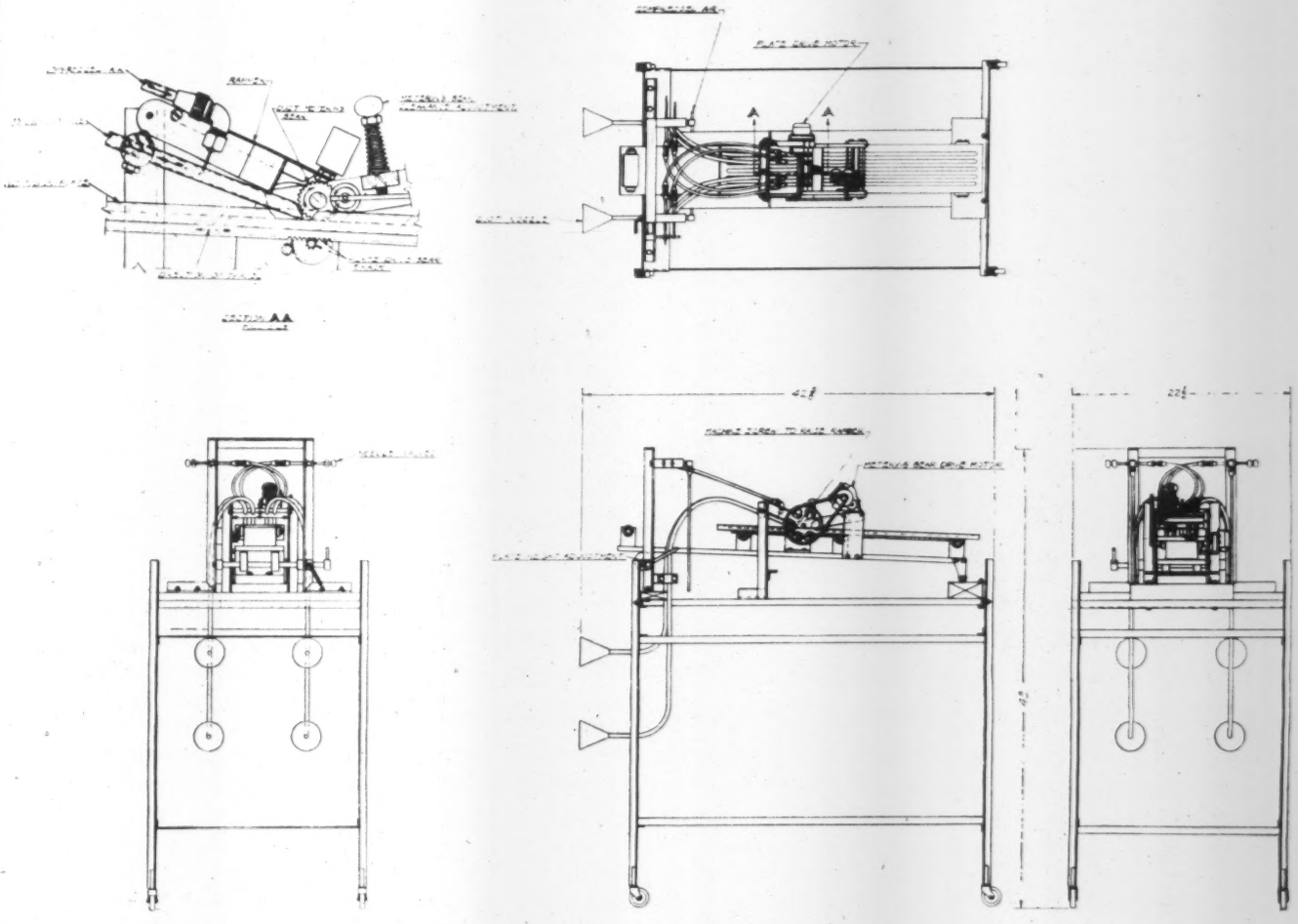


Fig. 4—Assembly—Far-air dust feeder

schemes given varied greatly. It was not until the dust feeder shown in Fig. 4 was developed, however, that satisfactory air and dust distribution was obtained.

Essentially the dust feeder described consists of a grooved plate that moves slowly forward by means of a rack and gear drive. The movement is 1.9 ft in one hour's time. A weighed amount of test dust is evenly spread along each of the four lateral grooves. Rotating gears which fit in the grooves continuously slice off minutely thin layers from the edge of the slowly advancing strips of dust. A controlled flow of compressed air aspirates the test dust sliced off by the gears through four tubes and delivers it to four distributing nozzles in the duct. A rapping device raps both the gears and aspiration tubes to keep them clean. The upper wall of this end of the duct is plate glass and it is a very rare occurrence to observe uneven *puffs* of dust as fed. Simple mechanical devices incorporated in the dust feeder provide ready adjustment of the plate to the aspiration tubes; the metering gears to the plate; and the amount and pressure of the injection air to each aspiration tube. With the four dust nozzles fixed in position as shown in Figs. 1 and 4, dust feed was adequately uniform for the dusts tested. A refinement is planned to permit scale adjustment of these nozzles.

Minimization of Test Variables

By using the equipment described it has been possible to obtain even dust distribution at the filter face within the limits of ±5 percent. This, in the opinion of the authors, is satisfactory. It has been their experience that no other dust feeder is so effective since it was found that dust distribution with other methods varied from over ±50 percent to variations of several hundred percent. Examples of dust distribution with this equipment are shown in Fig. 5. These distribution measurements were made by comparing the amount of dust collected by the Crismon dust samplers placed in the center of each quadrant of the duct with the amount collected by a sampler placed in the center of the duct. An example of the consistency of dust feed is shown in Table 2. The weight figures in Table 2 were obtained from the data of eight consecutive test runs of a routine filter test. In routine testing three or four pairs of samplers rotate in use. Each sampler has a different tare. No special care was taken in handling the samplers except that they were wiped with an alcohol cloth before weighing. Some samplers were weighed immediately; others were left as long as a day before weighing.

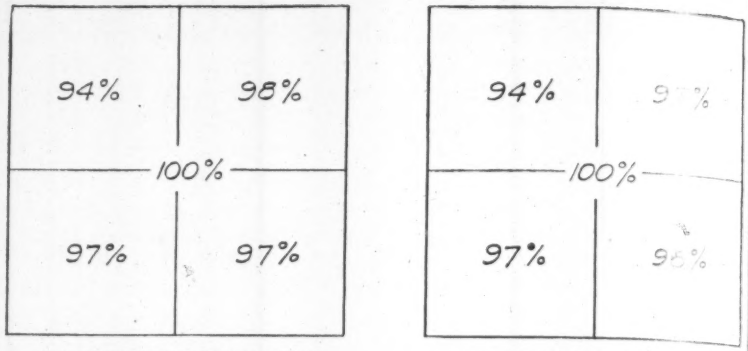


Fig. 5—Dust distribution in Far-air filter test duct when feeding Army standardized fine air cleaner test dust

Table 2—Example of the Consistency of Dust Feed from Far-Air Dust Feeder as Measured by Crismon Dust Samplers

Sampler Weight Gain in Grams 433 FPM Duct Velocity		Sampler Weight Gain in Grams 288 FPM Duct Velocity	
Upstream Sampler	Downstream Sampler	Upstream Sampler	Downstream Sampler
0.0136	0.0025	0.0074	0.0018
0.0141	0.0029	0.0076	0.0020
0.0137	0.0025	0.0076	0.0021
0.0133	0.0023	0.0076	0.0020
0.0134	0.0025	0.0077	0.0020
0.0135	0.0027	0.0075	0.0020
0.0136	0.0028	0.0078	0.0021
0.0134	0.0024	0.0075	0.0018

Detailed traverses of the test duct with an Alnor Velometer reveal that the air velocity variation at the filter face is about ± 15 to 20 percent. By carrying on a more systematic study of the size and location of the air inlet orifices than we have yet had time to do, it may be possible to improve this air velocity distribution. However, to get even distribution of air in a square duct is an extremely difficult thing to accomplish, as all of those who have experimented with low viscosity fluids will agree. A circular duct would probably offer certain advantages in this respect, but as stated previously, the test duct should be devised for testing standard air filter panels. An air velocity variation of ±15 to 20 percent appears to be well within other experimental limits; particularly since the dust distribution is held to ±5 percent.

The test apparatus described has minimized most of the important variables encountered in air filter testing with the exception of variables associated with a specific test dust. Because of the many ramifications of this problem it is believed that it can be overcome only by using a series of different dusts and dust mixtures. No one dust can be expected to meet all the requirements encountered in the field. The subject of test dusts is a complicated one about which much has been written, and on which there is much disagreement. It is enough to mention at this point, that generally speaking, any test dust decided upon should be composed of particle size ranges much smaller than those in current use; it should not have component particles of a sticky amorphous nature which agglomerate and resist dispersion so that the dust cannot be fed with even dispersal in a controlled manner. It must be a dust which can be reproduced to close specifica-

tions and preferably should be provided to all from a standard source. It has been suggested[7] that air filters be tested with dusts of narrow specified size ranges. This suggestion appears to have a great deal of merit and certainly should be included in any program searching for satisfactory test dusts.

Plotting Test Data

When air filter test data have been obtained, the question arises: How should these data be presented in order to show true rating of filter performance? It is believed that complete curves showing both air filter efficiency and air flow resistance *versus* dust load actually on the filter should be plotted. Curves which show efficiency and resistance *versus* dust fed to the filter or *versus* time do not give a true impression, are frequently misinterpreted, and, therefore, are misleading.

Past air filter testing codes classified air filters according to type and resistance characteristics and specified a different test velocity for each class. The filters were then tested until the efficiency dropped off a certain percentage or until the resistance built up to a certain point. At the completion of the test, some point on the performance curve (usually at the one-half total dust load point) was chosen as the point of *average* dust holding capacity, and the corresponding efficiency at this point was termed the *average* efficiency. Inasmuch as it is still common practice to furnish interested air filter users only these *average* figures and to write air filter specifications referring only to these *average* figures, it is believed that such a scheme is grossly misleading. True filter performance can only be shown by presenting full performance curves. There are many different types of air filters being used. Different types have wide variations in efficiency, resistance and dirt holding capacity. Any comparison made at one velocity or within one set of resistance limits does not necessarily hold for another. Since the main purpose of any test code is to further analysis of air filter performance, the authors believe that limitations of this sort deprive the intelligent and progressive engineer of valuable information that would assist him in designing air filter installations to more nearly suit his own peculiar space, power, efficiency and other requirements. This can only adequately be shown by presenting the full curve, or a family of curves if information is desired for various types of dusts or at various velocities.

Summary

This paper has pointed out basic requirements of adequate air filter testing methods and has outlined what the authors believe a good test code should include to meet these requirements. Most of the controversial discussions on the subject of air filter testing have centered around a suitable choice of test dusts. The matter of test dusts has consumed most of the energy which has been spent in trying to develop an adequate and acceptable test code even though the many known variables encountered in all testing methods used at the present time are so upsetting that no true picture of the relative advantages and disadvantages of any dust can be determined.

A description and drawings of the test duct and dust feeder developed by the authors is given. With this equipment the test dust at the face of the test filter is distributed within the limits of ±5 percent. This is a marked improvement over dust distributions obtained with other equipment in current use. The air velocity distribution at the filter face is within ±15 to 20 percent. This is only a small fraction of the differences found in other test methods.

A description of the Crismon dust sampler is given, together with the technique of its operation. Simultaneous sampling both upstream and downstream of the test filter is recommended so that the effect of any variables which occur during the sampling will appear in the factors obtained to compute efficiency.

The authors further recommend that all test data be plotted in full. The methods of arriving at *average* efficiency and resistance figures which have been in use in some air filter test methods are misleading. Since the main purpose of a test code is to provide means for reliable analysis of air filter performance only complete curves or families of curves at various velocities, or test data using various specified test dusts will enable the engineer to design his air filter installation to suit his particular requirements.

The authors believe that if other laboratories interested in establishing a satisfactory air filter test code should adopt the improved equipment described in this paper, a coordinated investigation of still unsolved problems, including the complicated problem of suitable test dusts, could be undertaken. Coordinated investigation would help to develop an acceptable air filter test code in a much shorter period of time.

Bibliography

1. Testing and Rating of Air Cleaning Devices Used for General Ventilation Work, by Samuel R. Lewis. (*Heating, Piping & Air Conditioning*, May, 1933.)

2. ASHVE Research Report No. 1094—Air Filter Performance as Affected by Kind of Dust, Rate of Dust Feed and Air Velocity Through Filter, by F. B. Rowley and R. C. Jordan. (ASHVE Transactions, Vol. 44, 1938, p.415.)

3. Air Flow Measurement in the Laboratory, by D. D. Wile. (*Refrigerating Engineering*, June, 1947.)

4. On the Quantitative Determination of Industrial Gas Dispersoids, by Evald Anderson. (*AIChE Transactions*, Vol. 34, No. 5, October 25, 1938.)

5. ASHVE Standard Code for Testing and Rating Air Cleaning Devices Used in General Ventilation Work, 1933. (ASHVE Transactions, Vol. 39, 1933, p.225.) (Since Withdrawn)

6. A Test Method for Air Filters, by R. S. Dill. (ASHVE Transactions, Vol. 44, 1938, p.379.)

7. Private communication with R. S. Dill.

JOURNAL SECTION

State Laws Concerning Industrial Exhaust Ventilation

By Knowlton J. Caplan,* Lansing, Mich., and Allen D. Brandt,** Sc.D., Bethlehem, Pa.

SUMMARY—A survey of state laws and regulations relating to industrial exhaust ventilation compiled from information furnished by state agencies responsible for promulgation and enforcement of the regulations.

THE PRESENT study of the scope of state laws concerning industrial exhaust ventilation was brought about by a meeting on March 13, 1945, under the auspices of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in Detroit, Mich. Shortly thereafter one of the authors was assigned by the U.S. Public Health Service to the ASHVE Research Laboratory for the purpose of conducting research in industrial exhaust ventilation. At that time the present study of state laws was instituted but it was soon apparent that the data contained in the various state codes were of little value in furnishing a ventilating engineer with the necessary design data for the adequate control of atmospheric contaminants in industry. Some of the states, it is true, have acceptable codes or standards applying to a few industries or operations but these do not indicate clearly some of the necessary design data.

In consequence, studies of exhaust ventilation problems were undertaken jointly by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and the U.S. Public Health Service at the Society's Research Laboratory in Cleveland, Ohio. This cooperative project resulted in papers on two studies of fundamental air flow problems [1, 2] and a partially completed survey of state ventilation codes. This survey has since been completed and results are reported in this paper.

The information in this survey of state laws was obtained by communication with the possible state agencies in each state responsible for industrial health conditions or ventilation inspection, or both. The emphasis is directed toward that ventilation which is essential for the control of potentially harmful working conditions rather than general ventilation such as would be covered by codes concerning public buildings, schools, and other public spaces. In some few cases a minimum of information was available from the state agency concerned, primarily because copies of the legislation were out of print. It is felt, however, that these few instances would not change seriously the results of the survey as a whole since those particular states disclaimed any extensive legislation or codes dealing with the subject.

Great Variation in State Ventilation Requirements

The results of the survey are tabulated and given in Table 1. The survey proves that the legal requirements varied tremendously from state to state all the way from no requirements to very complete and detailed requirements. It is interesting to note that 11 states have no direct coverage on the subject in either legislation, codes or standards; that 25 states have only very general requirements concerning the health conditions in industry; and that only six states have what may be regarded as a reasonably complete code or set of standards covering a number of typical operations or exhaust hood types. Of those states having rather complete codes it should be noted that two of them contain the design requirement that the area of the main should be equal to the combined area of the branches plus 20 percent. This criterion is recognized as being poor and inadequate for many types of systems.

With respect to particular operations, grinding and buffing were the most thoroughly covered; being mentioned by 12 states, five of which use the codes of the *American Standards Association* or closely similar data, and seven of which use standards other than *ASA*. Some of the non-*ASA* standards are far from practical. Spray coating and mine and tunnel ventilation were next in order of popularity, being covered by seven and six states respectively. There was little agreement in the requirements for these operations. The remainder of typical industrial operations was scattered throughout the legislation, more than 25 operations being covered in a sporadic manner.

Although the standards contained in legislation or codes are very inadequate for most states, the ventilation engineer can obtain information regarding the problems, properties and techniques of control of industrial health hazards by contacting the proper state agency

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**Industrial Hygiene Engineer, Bethlehem Steel Co. Member of ASHVE.

[1] ASHVE RESEARCH REPORT No. 1295—Energy Losses at Suction Hoods, by Allen D. Brandt and Russell J. Steffy. (ASHVE TRANSACTIONS, Vol. 52, 1946.)

[2] ASHVE RESEARCH REPORT—Nature of Air Flow at Suction Openings, by Allen D. Brandt, Russell J. Steffy, and Richard G. Huebscher. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1947.)

Presented at the 54th Annual Meeting of the AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS, New York, N. Y., February 1948.

Table 1—Characteristics of Industrial Ventilation Laws

Political Unit	Date of Legislation Revision or Latest Printing	Type of Law: Specific	Type of Law: Enabling Act plus Regulations	Type of Regulation: General	Type of Regulation: Specific Data or Standards	Scope of Contents	Remarks
Alabama	1947	No	Yes	None[a]	None[a]	-	-
Arizona	1945	-	-	-	-	-	Occupational disease Liability law
Arkansas State Board of Health	-	No	Yes	Yes	No	(1) Requires healthful and comfortable atmosphere; (2) Local exhaust required where possible to remove contaminants; (3) Outside pollution forbidden.	Contains other standards of industrial health
State Department of Labor	1943	No	Yes	Yes	No	Same as State Board of Health.	
California Department of Public Health	-	No	Yes	None	None	-	Broad general powers to protect public health
Department of Industrial Relations	1945	No	Yes	Yes	No	(1) Ventilation to be supplied to prevent hazards; (2) Discharged materials shall not re-enter places of employment in harmful quantities.	*Dusts, Fumes, Gases Safety Orders*
	1944	No	Yes	Yes	Yes	(1) 100 cfm per man; 500 cfm per animal.	*Mine Safety Orders*
	1944	No	Yes	Yes	Yes	(1) All enclosed or partially enclosed spaces shall be ventilated to remove dangerous concentrations of fumes and gases.	*Ship and Boat Building Safety Orders*
	1919	No	Yes	Yes	No	(1) *Good and sufficient amount of ventilation.*	*Tunnel Safety Rules*
Colorado State Board of Health	1941	No	Yes	Yes	No	Occupational environment must be maintained so that injury to health shall not result.	List of MAC[b]
Connecticut State Department of Health	1945	No	Yes	Yes	Yes	(1) Capture velocities; (2) Properties of hazardous chemicals; (3) Spray booth stds. (*spray coating, grinding, metallizing*); (4) Grinding wheel stds. (*ASA*);[c] (5) Buffing and polishing stds. (*ASA*); (6) Lateral slot hood stds. (*for plating, etc.*); (7) Semi-lateral tank hood stds. (*for plating, dipping, cleaning*); (8) Canopy hood stds. (*for nuisance materials only*); (9) Belt buffer and sander stds.; (10) Surface grinder stds.; (11) Slot and down-draft table stds.; (12) Ventilated tunnel stds.	List of MAC Regulations worded in general terms; stds. are in form of *Recommended Safe Practices*, not legal requirements
Dept. of Labor and Factory Inspection	1945	Yes	No	-	-	Grinding, polishing and buffing.	General terms
Delaware Labor Commission	-	Yes	No	-	-	Poisonous contaminants to be removed by local exhaust.	General terms
Florida State Board of Health	1947	No	Yes	Yes	No	Health hazards to be prevented; comfort zone air conditions to be maintained except in *hot industry*.	General terms List of MAC
Georgia Department of Public Health	1946	No	Yes	None[a]	None[a]	-	-
Department of Labor	1943	Yes	Yes	None	None	Employment shall include items necessary for reasonable life, health, safety and welfare.	General terms
Idaho Industrial Accident Board	1940	No	Yes	Yes	No	Concentrations of dust shall be held to certain limits (not specified).	General terms
Illinois Industrial Commission	1944	No	Yes	Yes	Yes	(1) Grinding, polishing and buffing stds. (*ASA*); (2) Tunnelling —*good and sufficient ventilation*; (3) Dip and flow coating & drying stds.; (4) Spray booth & spray room stds.; (5) Foundry shakeout stds.; (6) Sand handling stds.; (7) Tumbling mill stds. (*ASA*); (8) Abrasive blasting stds.; (9) General stds. of construction; (10) Recirculation (*foundries*) not permitted.	Standards incorporated in code and rules *Health and Safety Rules*

Table 1 (Continued)—Characteristics of Industrial Ventilation Laws

Political Unit	Date of Legislation Revision or Latest Printing	Type of Law: Specific	Type of Law: Enabling Act plus Regulations	Type of Regulation: General	Type of Regulation: Specific Data or Standards	Scope of Contents	Remarks
Indiana State Board of Health	1909	Yes	No	-	-	Prevent any conditions which may transmit, generate or promote disease.	Broad general powers
Administrative Bldg. Council of Indiana	1944	No	Yes	Yes	Yes	(1) Temperatures; (2) Exhaust required to remove health hazards; (3) Discharge not to cause nuisance or hazard; (4) Replacement air to be tempered; (5) Motion picture booth stds.; (6) Garage ventilation stds.	Mainly concerned with heating and ventilation instead of exhaust ventilation. *Heating, Ventilating and Air Conditioning Regulations*
Iowa Labor Department	1939	Yes	No	-	-	Require contaminants to be removed by ventilation.	General terms. *Health & Safety Appliance Laws*
Kansas	None	-	-	-	-	-	-
Kentucky State Board of Health	-	No	Yes	Yes	Yes	Requires control of any process, material or method of working known to have an adverse effect on health.	List of MAC
Louisiana Health Department	1890 (basic law)	No	Yes	Yes	Yes	Requires ventilation (local and general) sufficient to reduce the concentration of contaminants to within safe limits. No recirculation without special permission.	General terms List of MAC
Maine Dept. of Health and Welfare	1937	No	Yes	None	None	-	-
Maryland Dept. of Health	1939	No	Yes	Yes	Yes	Control of any process, material, etc. known to have an adverse effect on health.	General terms List of MAC
Massachusetts Labor and Industries Department	1940 (basic law)	Yes	Yes	Yes	Yes	Requires ventilation sufficient to render contaminants harmless; (2) Grinding, buffing & polishing stds. *(ASA)*; (3) Banker (granite cutting) stds.; (4) Degreaser stds.; (5) Wood heel industry stds.; (6) Metal spraying stds.; (7) Garage tail-pipe exhaust stds.	Law in general terms. Standards *advisory*
Michigan Dept. of Health	1943	No	Yes	None	None	-	Broad general powers to protect public health
Dept. of Labor and Industry	1945	Yes	No	-	-	(1) Exhaust fans to be provided for grinding and dust-creating machinery; (2) General foundry ventilation; (3) Grinding wheel stds. *(require 9000 fpm velocity)*.	
Minnesota Industrial Commission	1943	No	Yes	Yes	Yes	Control to reduce concentration of contaminants to MAC; Recirculation prohibited without special approval.	List of MAC General terms
Mississippi State Board of Health	1943	No	Yes	Yes	No	Ventilation to reduce all toxic materials below MAC.	General terms
Missouri Dept. of Labor and Industrial Inspection	1944	Yes	No	-	-	Ventilation to render impurities harmless; remove smoke and dust.	General terms
Montana State Board of Health	1939	No	Yes	None	None	-	Powers to protect the public health
Industrial Accident Board	1945	Yes	No	-	-	(1) Requires 150-200 cfm per person; 600 cfm per animal or loading machine; (2) Requires adequate ventilation.	(1) Coal mining laws; (2) Quartz mining laws
Nebraska Dept. of Labor	-	Yes	-	-	-	Work place must be safe & healthful.	General terms
Nevada Dept. of Health	-	No	Yes	None	None	-	Powers to protect the public health

Table 1 (Continued)—Characteristics of Industrial Ventilation Laws

Political Unit	Date of Legislation Revision or Latest Printing	Type of Law: Specific	Type of Law: Enabling Act plus Regulations	Type of Regulation: General	Type of Regulation: Specific Data or Standards	Scope of Contents	Remarks
New Hampshire Dept. of Health	1946	No	Yes	Yes	Yes	Control of hazardous contaminants to MAC.	List of MAC; Law requires Dept. of Labor & Dept. of Health to adopt identical regulations
New Jersey Dept. of Labor	1939	No	Yes	Yes	Yes	(1) Construction stds.; (2) Grinding, buffing & polishing stds.; (3) Woodworking machinery stds.; (4) Shoe mfg. stds.; (5) Pearl goods mfg. stds.; (6) Rubber goods mfg. stds.; (7) Flint grinding stds.; (8) Pottery mfg. stds.; (9) Celluloid goods mfg. stds.; (10) Printing est. stds.; (11) Laundry stds.; (12) Felt hatting stds.; (13) Fur dressing stds.; (14) Leather mfg. stds.; (15) Metal dipping (acid or alkali) stds.	Stds. have force of regulation Stds. call for design of mains on *area plus 20 percent basis* All stds. call for 2 in. static suction at throat of hood
New Mexico	None	-	-	-	-	-	-
New York	1931-1942	No	Yes	Yes	Yes	(1) Stone crushing operation stds. (control dust to certain limits, stds. on crushing, grinding, screens, storage bins, mixers, hoppers, elevators, material chutes, conveyors, bagging machines, barrel filling; construction stds.; recirculation prohibited); (2) Foundry operation stds. (control contaminants to certain limits; recirculation requires special approval. Stds. on shakeout, sand mullers, sand handling, screening, conveyors, elevators, storage bins, tumbling, grinding, polishing and buffing (*ASA*) swing grinding, abrasive blasting, construction stds. (3) Stone cutting and stone finishing stds. (control dust to certain limits. Stds. on pneumatic hand tools; surfacing machines; abrasive blasting; construction stds. Recirculation prohibited); (4) Rock drilling stds. (wet drilling or exhaust ventilation to control dust to certain limits); (5) Spray coating of motor vehicle stds. (construction stds.; spray booths, room and hood stds.); (6) Laundry stds. (stds. in general terms. Detail stds. on a few operations); (7) Removal of dust, gases and fumes (construction stds. Recirculation requires approval. Stds. on cyclone separators; grinding, buffing and polishing; wood working; general stds. for other contaminants).	Stds. have force of regulation Plans approval required Lists of MAC Some of the codes require testing of the exhaust system and air contamination after the system is installed Codes provide for exceptions from the stds. on approval of the State because of *stringent circumstances*
North Carolina Dept. of Labor	1945	Yes	Yes	Yes	Yes	(1) Requires adequate exhaust to remove dusts, gases, fumes, vapors or odors. Stds. on humidity in textile plants. (2) Ventilation in mines and quarries required to bring dust to safe concentration as determined by State Board of Health.	General terms
North Dakota Workmens Compensation Bureau	1941	No	Yes	Yes	No	(1) Ventilation shall be such as to minimize air contaminants; (2) Spray rooms: one air change per minute.	General terms
Ohio Dept. of Health	1946	No	Yes	Yes	Yes	(1) Requires adequate exhaust, (local exhaust preferred) to reduce contaminants to MAC; (2) Recirculation restricted.	General terms List of MAC
Dept. of Industrial Relations	1942	No	Yes	Yes	Yes	(1) Blowers and exhausters (1942) stds. of pipe size US wheel size for grinding and buffing (not *ASA*), construction stds; design of mains on *area plus 20 percent basis;* requires 5 in. w.g. suction at throat; (2) Requires exhaust of woodworking machinery. No stds.;	Blowers and Exhausters *Polishing and Grinding Machines* *Operation & Maintenance of Woodworking Machinery*

Table 1 (Continued)—Characteristics of Industrial Ventilation Laws

Political Unit	Date of Legislation Revision or Latest Printing	Type of Law: Specific	Type of Law: Enabling Act plus Regulations	Type of Regulation: General	Type of Regulation: Specific Data or Standards	Scope of Contents	Remarks
Ohio Dept. of Industrial Relations (*continued*)						(3) Foundries (1944). Requires *adequate* ventilation of four air changes per hour; requires ventilation for tumblers, sandblast, core knock-out, drying ovens; no stds.; (4) Factories; requires 400 cu ft per employee or ½ cfm per sq ft floor area; (5) Dry cleaning; air change every 3 min, every 2 min for flammable solvents.	*Operations & Conditions in Foundries* *Workshops, Factories, Mercantile and Office Buildings* *Dry Cleaning Establishments*
Oklahoma Dept. of Labor	1936	No	Yes	Yes	Yes	(1) Grinding wheel stds. (not *ASA*); (2) Requires contaminants be held to safe limits; special mention of spray coating and plating.	List of MAC
Oregon State Board of Health	1945	No	Yes	Yes	Yes	Requires local or general exhaust to reduce contaminants to safe limits. Recirculation prohibited.	List of MAC; Identical rules adopted by Industrial Accident Commission
Pennsylvania Dept. of Labor and Industry	1944	No	Yes	Yes	Yes	(1) Requires control of contaminants to a safe level; (2) Abrasive and polishing wheels; requires 2 in. w.g. suction at throat; no stds. on air volume, branch sizes, etc. Also requires exhaust of sanders, tumblers, etc.; (3) Spray coating: Twenty air changes per hour in spray rooms; no stds. on spray booths.	*Miscellaneous Hazards* *Abrasive and Polishing Wheels* *Spray Coating*
Rhode Island Dept. of Labor	1946	No	Yes	None	None	-	-
South Carolina State Board of Health	1944	No	Yes	Yes	Yes	Requires contaminants to be kept below safe concentration.	List of MAC
South Dakota	None	-	-	-	-	-	-
Tennessee State Dept. of Public Health	1945	Yes	No	-	-	Requires healthful working conditions be maintained.	Regulation prohibited. Each case on its own merits
Texas State Board of Health	1945	Yes	No	-	-	Requires healthful working conditions.	Advisory (not legal) MAC list
Bureau of Labor Statistics	1946	Yes	No	-	-	Requires contaminants to be removed insofar as practicable.	General terms
Utah Industrial Commission	1945	No	Yes	Yes	No	Names ventilation as one means to reduce concentration of contaminants wherever practical.	General terms
Vermont Dept. of Public Health	1941	Yes	Yes	Yes	No	Requires contaminants to be reduced to a safe level.	General terms
Virginia	None	-	-	-	-	-	-
Washington Dept. of Labor and Industries	1946	No	Yes	Yes	Yes	(1) Requires control of contaminants to MAC; recirculation of harmful concentrations or amounts of contaminant prohibited; (2) Table of general ventilation requirements; (3) Spray rooms: two air changes per minute; no stds. on spray booths; (4) Grinding wheels stds. (*ASA*).	List of MAC *Safety Standards for Protection Against Occupationally Acquired Diseases* *General Safety Standards*
West Virginia	None	-	-	-	-	-	-
Wisconsin Industrial Commission	1941	No	Yes	Yes	Yes	(1) Ventilation required to reduce contaminants to MAC; recirculation restricted; formulas (involving sp. gr.) for calculation of necessary control velocity at hood; construction stds.; (2) Spray coating: 100 linear feet per minute at breathing zone; elaborate construction stds.; (3) Tunnel stds.: 30 cfm per person.	List of MAC; Plans approval required. *General Orders on Dusts, Fumes, Gases and Vapors; General Orders on Spray Coating; Tunnel, Caisson and Trench Construction;* General ventilation rules in *Heating, Ventilation & Air Conditioning Code*
Wyoming	None	-	-	-	-	-	-

[a] Agency has power to make regulations but none has been made.
[b] Maximum Allowable Concentration of harmful air contaminants.
[c] *American Standards Association* standards.

in the respective state. There are, at the present time, staffs of engineers familiar with industrial health hazards in 43 states and six cities. All areas, except Arizona, Delaware, Nevada, New Mexico, and North Dakota, are provided with some type of service along these lines. In all of these states, with the exception of Massachusetts and New York, the responsibility for the control of industrial health hazards rests with the state health department; in Massachusetts and New York, with the department of labor; and in some states with both the department of labor and the department of health.

It is recommended, after studying the many examples of state legislation on the subject, that specific and quantitative design criteria should not be included in legislation. Rather, such data, standards and recommendations should be incorporated in regulations or in advisory standards accompanying regulations in order that greater flexibility may be obtained. Furthermore, some means should be provided for the approval of control measures in those few instances in which the health hazard is adequately controlled, even though the control measures do not meet the standards and were provided under circumstances which do not fit the typical conditions upon which the standards were based.

WESTERN MICHIGAN CHAPTER TREASURER DIES

Chauncey A. Simonds, treasurer of the Western Michigan Chapter of the ASHVE and a member of the Society since 1944, died on December 8, 1947. Mr. Simonds was the owner of the Chauncey A. Simonds firm, Grand Rapids, Mich.

A native of Grand Rapids, Mich., Mr. Simonds was born on May 26, 1885. He attended Central High School preparatory to entering Michigan Agricultural College from which he graduated in 1905. His first position was with the Frank A. Simonds consulting engineering firm as assistant and student in mechanical engineering practices. Mr. Chauncey was active with this firm in experimental and research work, designing, testing and selling, for a number of years. During the first World War he served with the utility detachment, construction division, U. S. Army. In 1919, he became a partner in the firm of Frank A. Simonds and Son, and in 1942 he organized his own firm.

The Officers and Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS join the Western Michigan Chapter in extending their sincere sympathy to his family.

ROBERT CLOSE DEAD AT 59

Word was recently received of the death on November 11, 1947, of Robert Close, Leonia, N. J. Mr. Close, who would have been 60 this April, was buried in Brookside Cemetery.

A native of Larne, Ireland, Mr. Close received his technical training at Belfast Technical School, and Belfast Engineering Academy, from which he graduated with an M. E. Degree in 1913. He became chief air conditioning engineer for the National Broadcasting Co., New York, in 1928, a position which he held at the time of his death. He was active in the supervision of maintenance and operation, and the inspection and development of new air conditioning installations.

Surviving are his widow and daughter to whom the Officers and Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS extend their deepest regrets.

N. S. THOMPSON, LIFE MEMBER, DIES

Nelson S. Thompson, Washington, D. C., a member of the ASHVE for over half a century, died on December 28, 1947, at the age of 76. A retired engineer, Mr. Thompson was a Life Member of the Society.

Born in Bethlehem, Pa., on September 7, 1871, Mr. Thompson attended public schools. In 1886 he began his training for the engineering profession by serving as an apprentice with the Atlas Engine Works. He accepted a position as a draftsman of heating and ventilating apparatus with the Supervising Architects Office of the U. S. Treasury Dept., in 1891. For the balance of his professional career he remained in the service of the U. S. Government, retiring a few years ago from his position as chief mechanical engineer.

Mr. Thompson joined the Society in 1897 as a junior member, was advanced to full membership in 1917, and elected to life membership in 1938. He was the author of several technical papers on heating of federal buildings which were presented at Society meetings, and he was the author of a book on hot water systems.

The Officers and Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS offer their sincere condolences to his sister, Bessie H. Thompson and to his other survivors for their sad loss.

DEATH OF J. L. FOLEY

John L. Foley, Westinghouse Electric Corp., Cleveland, Ohio, passed away on August 4, 1947. Mr. Foley, who joined the Society in 1938, was a member of the Northern Ohio Chapter.

A native of Southampton, Mass., Mr. Foley would have been 48 in May. He received his degree as a mechanical engineer in 1921 from the Mechanic Institute, Rochester, N. Y. His first position was as plant superintendent for the John G. Elbs Co., Rochester, N. Y. In 1927 he became district manager for the York Heating and Ventilating Corp., now a part of the Carrier Corp., Syracuse, N. Y. He accepted a position as manager of the wholesale department, Avery Engineering Co., Cleveland, Ohio, in 1938, and later became affiliated with the Westinghouse Electric Corp., in Pittsburgh, Pa., and Cleveland, Ohio, as a Precipitron specialist, a position which he held at the time of his death.

Mr. Foley was a member of the Rotary Club and also held membership in the Ohio Professional Engineers Society.

The Officers and Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS extend their sincere sympathy to his family for their untimely loss.

Summary of Local Chapter Meetings*

ATLANTA—December 5, 1947. Subject: Stag Smoker. Officers for 1948 were installed as follows: L. L. Barnes, *president;* Leo Sudderth, Jr., *vice president,* R. L. Beach, *secretary,* E. K. Jamison, *treasurer* and H. King McCain and Boynton Cole as members of the *board of governors.* The appointment of chapter chairmen for the coming season completed the official business for the evening and members enjoyed the entertainment which followed. Attendance 56.

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CENTRAL OHIO—November 29, 1947. Subject: Panel Discussion on Modern Zoning in Automatic Controls. Moderator: W. M. Myler, Jr., chief engineer, Janitrol Engrg. Dept., Surface Combustion Corp., Columbus, Ohio. R. S. Curl opened the discussion with comments on the various factors that influence the heat gain and loss of different parts of the structure to be heated. Mr. Wilson continued the discussion with comments on the problems connected with the points brought out by the preceding speaker and also mentioned the resultant reasons for zoning which primarily involve the comfort of the occupants. The difficulties surrounding the heating and ventilating of large open areas where shipping and receiving departments are located and the effect of such openings on comfort conditions elsewhere in the building were discussed by Mr. Lietzel. R. D. Ashley, L. J. Nichols and J. D. Slemmons also participated in the panel. Attendance 45. Attendance ratio 0.43.

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CONNECTICUT—November 19, 1947. Subject: Radiant Heating. Speaker: T. Napier Adlam, vice president and general manager, Sarco Manufacturing Corp., New York, N. Y. Mr. Adlam's talk was received with enthusiasm and the questions asked during the discussion period were evidence that his presentation was of great interest to the members. Other Features: Pres. S. R. Osborne announced that the chapter secretary has reservation blanks for hotel rooms for all members interested in attending the 54th Annual Meeting in New York, N. Y. It was also announced that Connecticut Chapter rosters have been mailed to all members. Attendance 100.

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DELTA—December 9, 1947. Pres. J. S. Burke announced that the speaker for the evening, John Manion, Carrier Corp., was detained due to local weather conditions which forced back his plane. Programs for coming meetings were announced. A report was given on a proposed engineering law and comments were made on revision of a building code. Attendance 37.

DELTA—November 11, 1947. Subject: Radiant Heat. Speaker: Stanley R. Osborne, project engineer, development department, Chase Brass & Copper Co., Waterbury, Conn. Mr. Osborne's talk was followed by questions from the floor. Other Features: Several members of the *Louisiana Architects Association* were present and a member of this group, Murvan Maxwell, was introduced and expressed the desire for more joint meetings between the architects and engineers. Attendance 48.

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GOLDEN GATE — December 4, 1947. Subject: Growing Pains. Speaker: Dr. Baldwin M. Woods, president of the ASHVE and director, university extension, University of California, Berkeley, Calif. Dr. Woods' talk was concerned mainly with the workings of the Society. In answer to questions from the floor he spoke of the voluntary contributions of papers by members of the Society of the cooperative projects connected with the Research Laboratory, and discussed the standardization of codes. Other Features: Suggestions for improving the *Fog Dispenser,* the chapter's publication, were given by members upon the request of the editor. A letter from the State Board of Registration of Engineers pertaining to application blanks was also read. Attendance 66.

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ILLINOIS—December 8, 1947. Subject: Control of Air-Borne Infection by Sanitary Ventilation. Speaker: W. F. Wells, director of the laboratory for study of air-borne infection, University of Pennsylvania Medical School, Philadelphia, Pa. Mr. Wells pointed out the results of work which he had done for various schools and explained several charts covering mortality rates and their relationship to his subject. The second subject, Electronic Air Cleaning—Theory and Practice, was presented by J. W. May, director of research, American Air Filter Co., Louisville, Ky. Mr. May compared electronic filters with other types and explained the means and methods of measuring the effectiveness of each. The construction of electronic filters and the theories on which they function were also explained. Attendance 102. Attendance ratio 0.27.

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KANSAS CITY—December 1, 1947. Subject: Engineered Air Distribution. Speaker: V. M. Lathers, Barber-Colman Co., Rockford, Ill. Mr. Lathers after discussing the sound measuring meter and decibel ratings, displayed a chart showing ratings for various applications of air movement. His excellent talk was

*NOTE: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

accompanied by a group of slides showing smoke tests, charts and instruments used in the laboratory. Several slides of a new laboratory now being constructed by Mr. Lathers' company were also shown. Other Features: Pres. P. C. Leffel announced that H. E. Gould had been appointed chapter delegate to the Annual Meeting with Henry Nottberg, Jr., serving as alternate. A notice from the Builders' Association of Kansas City regarding a future meeting of all organizations interested in building costs was also read. Attendance 75.

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MANITOBA — November 20, 1947. Subject: Debate on What Type of Heating System Shall I Install in My New Home. Speakers: D. F. Michie, and O. J. Hatch. Mr. Michie defended the hot water system in the debate. Opposing him was Mr. Hatch who spoke in favor of the winter air conditioning system. Upon the completion of the speakers' interesting comments, three judges declared the debate a draw and both speakers were complimented for their presentations. An open discussion was then held on the subject with all members joining in. Attendance 18.

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MASSACHUSETTS—December 19, 1947. Subject: Joint Social Meeting with the Boston Section, *American Society of Refrigerating Engineers*. Bill Summers, American League baseball umpire amused members and their guests with his baseball anecdotes, stories, and jokes. Motion pictures on big game stalking, salmon fishing, and world series baseball were also shown. Attendance 104.

MASSACHUSETTS — November 20, 1947. Subject: Reverse Cycle Refrigeration Combined with Radiant Heating. Speaker: Carl F. Boester, housing research executive, Purdue Research Foundation, Purdue University, Lafayette, Ind. The subject was extremely well presented by Mr. Boester and a lively discussion period ensued. Attendance 90.

MICHIGAN—December 15, 1947. Subject: The New Smoke Ordinance. Speakers: Commissioner Joseph P. Wolff, department of buildings and safety engineering, Detroit, Mich. The commissioner explained the necessity of the new smoke ordinance, the problems that attended its preparation and passage and the problems of enforcement. The Commissioner handled his subject in a very able manner and was called upon to answer a considerable number of interesting questions. The second speaker for the evening was Hugh P. Dolan, director of engineering and operation of buildings, Board of Education, Detroit, Mich. Mr. Dolan presented the problem of compliance with the new smoke ordinance from the operator's standpoint and stated that the skill of the operator was the greatest single factor involved in the prevention of smoke. A lively question and answer period followed Mr. Dolan's talk. Attendance 90.

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MINNESOTA—December 1, 1947. Subject: Air Filtration in Heating, Ventilating and Air Conditioning. Speaker: Roy E. Hunsaker, manager, equipment sales division, Owens-Corning Fiberglas Corp., Toledo, Ohio. Mr. Hunsaker used a chart to illustrate the different classifications of dust particles and to describe the selection of filters from cost and efficiency standpoints. Other Features: Entertainment for the evening was provided by the Golden Guernsey Male Quartette, whose songs were greatly enjoyed by members. Attendance 71.

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MONTREAL — December 16, 1947. Subject: Christmas Party. One of the highlights of the evening was a quiz program conducted by *Professor Timmie Timmins*. J. J. Cosgrove, as Santa Claus, distributed gifts among the members. Attendance 57.

MONTREAL — November 10, 1947. Subject: Engineered Air Distribution. Speaker: V. M. Lathers, Barber-Colman Co., Rockford, Ill. Mr. Lathers again proved his ability as a speaker and members found his presentation highly interesting. An active discussion period followed in which members demonstrated their interest in the subject by the many questions asked. Attendance 62.

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NORTH TEXAS—December 17, 1947. Subject: Annual Christmas Stag Party. Joint meeting with South Texas Chapter. The new officers for 1948 were introduced as follows: B. S. Foss, Jr., *president;* G. A. Linskie, *vice president;* Herman Blum, Jr., *secretary;* A. B. Ullrich, Jr., *treasurer;* and C. R. Gardner, M. L. Brown and L. S. Gilbert, members of *board of governors*. Wayne E. Long, professor of mechanical engineering at the Texas A. & M. College, gave a brief talk on the activities of the Student Branch at the college and presented a gavel which was made from a piece of the stair railing of old Gathright Hall, the first building to be constructed on the A. & M. campus. After Mr. Long announced that no provision was made in the Society's By-Laws for student delegates to the Annual Meeting, members subscribed a total of $380.00 for the transportation and expenses of two members of the Texas A. & M. Student Branch to attend the 54th Annual Meeting. Herman Blum, program chairman then took charge of the meeting and members enjoyed the lively entertainment features which followed. Attendance 190.

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NORTHERN OHIO — December 8, 1947. Subject: Basic Principles of Nuclear Reaction. Speaker: Dr. Donald J. Hughes, director, experimental physics division of the Argonne National Laboratory, Chicago, Ill. In his talk Dr. Hughes covered the necessary progressive steps which finally resulted in the atomic bomb. After covering the basic principles of nuclear reaction, Dr. Hughes described the non-military benefits of the tremendous energy available from this reaction. Other Features: A brief *coffee talk* was

given by J. W. Jergen, of the Council on World Affairs. Reports were given by the chairmen of the various committees. Pres. John James announced that the Cleveland Technical Societies Council had decided to supervise the publication of the weekly *Cleveland Engineering Bulletin*, and that the annual banquet of the Council would be held on January 26, 1948. D. E. Mannen, of the entertainment committee, was selected to investigate the possibility of special transportation for Cleveland members to the 54th Annual Meeting. W. R. Moore was elected to serve as chapter delegate for the coming year with L. S. Ries as alternate. G. L. Tuve announced that the Semi-Annual Meeting would be held in Bretton Woods, N. H., and stated that he hoped the Northern Ohio Chapter would be well represented at the coming Annual Meeting, where many excellent technical papers will be presented. Attendance 62.

NORTHERN OHIO — November 17, 1947. Subject: Technology Tomorrow. Speaker: Dr. Baldwin M. Woods, president of the ASHVE, and director, university extension, University of California, Berkeley, Calif. In addition to tracing the development and the future possibilities of inventions in his talk on technology, Dr. Woods gave a report on the affairs of the Society which proved of great interest to members. Other Features: Among the distinguished visitors present were S. H. Downs, G. L. Tuve, L. T. Avery, and A. V. Hutchinson. R. L. Byers, a member of the Chapter's board of governors, gave a brief history of the Chapter's history since it was organized in 1916, and after listing the past presidents, introduced those present. Pres. John James presented certificates of Life Membership in the chapter to C. F. Eveleth and C. Gottwald. Several committee reports were given and after G. P. Nachman, chairman of the legislation committee, reported on the proposed new Cleveland Building Code, a discussion of building codes followed in which L. T. Avery, Dr. Woods, A. V. Hutchinson and Cyril Tasker participated. Attendance 95.

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ONTARIO—December 1, 1947. Subject: Economical Heating of Buildings. Speaker: H. T. Kucera, president, Automatic Devices Co., Chicago, Ill. Members greatly enjoyed Mr. Kucera's informative talk. Attendance 117. Attendance ratio 0.53.

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OREGON—November 6. 1947. Subject: Kitchen Exhaust Systems. Speaker: Miles Woodworth, fire marshal, City of Portland, Ore. Mr. Woodworth's timely talk proved of interest to members. Other Features: Colonel Walsh, U. S. Army Engineer asked the sponsorship of the Chapter for an Affiliated Maintenance Unit. This unit, consisting of two officers and 39 enlisted men would be called to active duty in case of an emergency. Ray Chewning, treasurer, reported on Chapter finances, and B. W. Farnes reported on expenses for the trip to the 54th Annual Meeting. A motion was carried that identification badges be secured for the membership. Attendance 68. Attendance ratio 0.39.

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PACIFIC NORTHWEST — October 14, 1947. Subject: History of Hot Water Heating. Speaker: E. L. Weber, consulting engineer, Seattle, Wash. In speaking of the history of hot water heating, Mr. Weber discussed how this method of heating had progressed and developed since its crude usage and application over 300 years ago. He concluded with a discussion of the present-day application of hot water heating. An extensive discussion period followed Mr. Weber's presentation, and it was proposed that an entire meeting be devoted to this interesting subject in the near future. Other Features: A round table discussion was held on the licensing of professional engineers in various classifications, following an inquiry by J. B. Notkin as to the stand the Chapter was taking on this matter. A motion was carried that an invitation for a joint meeting be extended to the Oregon Chapter. Attendance 27.

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PHILADELPHIA—December 1, 1947. Subject: The Mechanism of Heat Transfer, Panel Cooling and Heat Storage. Speaker: C. S. Leopold, consulting engineer, Philadelphia, Pa., and past president of the ASRE. Mr. Leopold's presentation was followed by a discussion period. Other Features: H. B. Hedges presented the Society Life Membership Award to M. B. Shea, who was also honored with life membership in the local chapter. Attendance 135.

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PITTSBURGH — December 8, 1947. Subject: Heating the Home of the Future. Speaker: Carl F. Boester, housing research executive, Purdue Research Foundation, Purdue University, Lafayette, Ind. From his experience in the heating field Mr. Boester stated that the house of the future would probably be heated by the heat pump method, using either the earth-to-air or air-to-air system. He also mentioned the possibility of using electric resistor elements with aluminum foil strips which heat up in 90 seconds, although so far the cost of operating this method has not been determined. Mr. Boester used slides to illustrate the workings of different methods. Other Features: Various committee reports were given and Pres. D. W. Loucks reported on the 54th Annual Meeting to be held in New York, N. Y. Attendance 53. Attendance ratio 0.27.

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ROCKY MOUNTAIN — December 31, 1947. Subject: Business Meeting. A pamphlet containing suggestions for improving chapter meetings was distributed and the list of speakers and subjects available through the ASHVE speakers' bureau was read. The type of program preferred by members was discussed and the majority of members indicated their preference for programs on the latest methods of heating, though a wide range of subjects was also desired. After it was announced that the State Board of Examiners

for Engineers and Land Surveyors had no representation from the heating, ventilating and air conditioning profession, a motion was carried that the legislative committee contact the proper authorities and urge them to appoint a qualified member from the ASHVE. Attendance 19.

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ST. LOUIS—December 2, 1947. Subject: Odors—Their Nature, Cause and Control. Speaker: Henry Sleik, vice president, W. B. Connor Engineering Co., New York, N. Y. In his well prepared review of the subject, Mr. Sleik gave the basic characteristics and effects of odors and explained the advantages of removing odors from air conditioning systems by the use of carbon canisters. A rising applause of appreciation was given to the speaker for his excellent talk. Other Features: Committee reports were given by the chairmen, and W. A. Russell announced that identification badges for members had been purchased and would be distributed. Attendance 55.

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SOUTH TEXAS—December 15, 1947. Subject: Christmas Program. A ventriloquist provided most of the entertainment for the program. Harold Broadwell, chairman of the program committee, commented briefly on the plans for the January meeting when Dr. Baldwin M. Woods, president of the ASHVE, and director, University Extension, University of California, Berkeley, Calif., was scheduled as guest speaker. Attendance 77.

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SOUTHERN CALIFORNIA — December 17, 1947. Subject: Control of Radiant Panel Heating. Speaker: R. C. Cushing, regional sales manager, Minneapolis - Honeywell Regulator Co. Mr. Cushing described and illustrated with slides the various systems required for proper control of the many applications of panel heat. The discussion period which followed dealt mainly with a general discussion of panel heating. Other Features: R. A. Lowe, *president*, reported on the progress made in securing a special railway car for those attending the 54th Annual Meeting. Attendance 88.

SOUTHERN CALIFORNIA—November 19, 1947. Subject: Centrifugal *vs.* Reciprocating Compressors. Speakers: Maron Kennedy, application engineer, York Corp., Los Angeles, Calif., and H. D. Moore, Worthington Pump and Machinery Corp. Mr. Kennedy began his talk with a brief history of the development of the centrifugal compressor. Mr. Moore discussed refrigerants and the comparison of horsepower per ton ratios under various conditions, illustrating his discussion with slides. During the interesting and informative discussion period which followed, both speakers alternated in answering questions. Other Features: A. G. Orear entertained members with the excellent color movies which he took at the summer meeting at Coronado, and on his vacation trip through Mexico. Pres. R. A. Lowe appointed C. W. Pollock to represent the chapter on a committee to act in an advisory capacity to the heating department of the city of Los Angeles. Attendance 99.

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SOUTHWEST TEXAS — December 9, 1947. Subject: The Need for Thermal Control of Ventilation in Schools of this Area. Speaker: Michael J. Murray, John J. Nesbitt, Inc., Dallas, Tex. Mr. Murray illustrated his interesting topic with slides and a lively discussion period followed. Other Features: G. R. Rhine was appointed delegate to the 54th Annual Meeting in New York with Ira W. Wilke serving as alternate. Attendance 25.

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UTAH—November 13, 1947. Subject: Research Projects of Interest to Utah. Speakers: Dr. A. Ray Olpin, president, University of Utah, and Dean C. J. Christiansen, Dean of the Mine School, University of Utah. Dr. Olpin stressed the importance of basic research in the development of the natural resources of Utah and the inter-mountain area, which would also provide work for locally trained engineers and technicians. Dean Christiansen pointed out that Utah as one of the world's largest bituminous coal fields will be called upon by the Pacific Coast industrial centers to supply processed liquid and gaseous fuels within a very few years. Additional research will be necessary to perfect the known solid field processing methods to higher efficiencies so that they will be economically feasible. Attendance 39. Attendance ratio 0.6.

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VIRGINIA — November 13, 1947. Subject: Technology Tomorrow. Speaker: Dr. Baldwin M. Woods, national president of the ASHVE and director, university extension, University of California, Berkeley, Calif. Dr. Woods explained the development and effects of inventions in the past which are the basis for many important present-day industries and mentioned possible inventions which would develop into large industries in the future. Other Features: The report of the nominating committee was given by R. C. Thomas, chapter president, who also announced that a chapter delegate and alternate would be selected from those planning to attend the 54th Annual Meeting. Attendance 43.

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WASHINGTON, D. C.—November 12, 1947. Subject: Technology Tomorrow. Speaker: Dr. Baldwin M. Woods, president of the ASHVE and director, University Extension, University of California, Berkeley, Calif. Dr. Woods traced the growth of important industries and the trends of industrial inventions. In concluding his interesting speech he expressed a feeling of optimism for industry generally. After a discussion period H. H. Hill, president of the chapter, thanked Dr. Woods for honoring the Washington, D. C. Chapter with a visit. Other Features: Reports were given by the chairmen of the membership and meetings committees and J. G.

Muirheid, delegate to the District of Columbia *Council of Engineering and Architectural Societies* announced plans of the Council to promote the inclusion of announcements of local technical meetings in the Sunday editions of Washington newspapers. Attendance 56.

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WESTERN MICHIGAN—November 10, 1947. Subject: Motion Picture—Operation of a Temperature Controls Plant. Speaker: W. J. Hajek, manager, air conditioning controls division, Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn. Mr. Hajek commented on the film and on the engineering principle involved in the use of the company's product. Other Features: A motion was carried providing for the purchase of membership badges and a suggestion was made that if groups were formed, bus service to meetings could be arranged for members. Attendance 78. Attendance ratio 0.92.

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WESTERN NEW YORK — December 19, 1947. Subject: Christmas Party. Members greatly enjoyed the entertainment features which had been planned for the annual Christmas party. All formal business was dispensed with. Attendance 79. Attendance ratio 0.92.

WESTERN NEW YORK—November 11, 1947. Subject: The War in the Far East. Speaker: Colonel Swanton, U. S. Army. Colonel Swanton, who was in Manila when Pearl Harbor was attacked and who was a member of General Wainwright's force during the *Death March*, gave an account of the war in the Far East. Other Features: A report on the activities of the Niagara Frontier Engineering Council was given and the appointment of Roswell Farnham as permanent chapter delegate to Society meetings was announced. Attendance 36. Attendance ratio 0.58.

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WISCONSIN — November 17, 1947. Subject: General Corrosion Characteristics of Ferrous and Nonferrous Metals. Speaker: L. G. Vande Bogart, research engineer in charge of the chemical section, engineering and research division, the Crane Co., Chicago, Ill. Mr. Vande Bogart indicated that the lack of understanding of the corrosion problem was probably due to the lack of simple language with which to describe it. He explained the three basic types of corrosion and used slides and illustrations to describe each type. An indication of some probable corrosions and solutions which might be used in handling this problem were also covered. Following the discussion period, a rising vote of thanks was accorded the speaker. Attendance 58.

Student Branch

TEXAS A. & M.—December 11, 1947. Subject: Pneumatic Regulators. Speaker: C. C. Quin, Powers Regulator Co., Houston, Tex. Mr. Quin used slides to illustrate his interesting discussion of the applications and installations of pneumatic regulators. Other Features: The chairman of the placement committee spoke briefly on the possibilities of employment for members. Attendance 25.

TEXAS A. & M.—November 20, 1947. Subject: Radiant Heating. Speaker: George R. Rhine, consulting engineer, San Antonio, Tex. Mr. Rhine discussed the load calculations of panel heating systems, problems encountered, and practical installations of these systems. Other Features: W. E. Long discussed the possibility of sending a student delegate to the 54th Annual Meeting. A motion was carried that chapter meetings be held twice a month. Attendance 64.

ASRE ELECTS M. C. TURPIN TREASURER

At the 43rd Annual Meeting of the *American Society of Refrigerating Engineers*, held in December, 1947, M. C. Turpin was elected secretary of the Society. Mr. Turpin, who has been serving as acting secretary of the *ASRE* since June, 1947, is also secretary of all Technical and Standards Committees and is a charter member and chairman of the local Baltimore-Washington Section of the *ASRE*.

Prior to his election as secretary, Mr. Turpin had been connected with the Westinghouse Electric Corp., since 1909, and had served as sales manager in the merchandising department of its Washington, D. C. office for 15 years. He had also been active for many years in the preparation of technical literature and press releases for the Westinghouse Corp.

F. S. HAMER HEADS DAYTON OFFICE

F. S. Hamer, a member of the ASHVE, will head the recently opened Dayton, Ohio headquarters of the Surface Combustion Corp., as district sales manager of the space heating division. Prior to his new appointment Mr. Hamer was associated with the Columbus plant of the Surface Combustion Corp., as a sales engineer.

A graduate of the University of Cincinnati with an electrical engineering degree, Mr. Hamer has had more than 20 years experience in the heating industry.

OIL-HEAT INSTITUTE ANNOUNCES ELECTION

The board of directors of the Oil-Heat Institute of America, Inc., has announced the election of Paul K. Addams, New York, N. Y., to its executive committee. Mr. Addams, president, Fitzgibbons Boiler Co., Inc., and a member of the ASHVE, also serves the *OHI* as vice chairman of the accessory division and chairman of the steel supply committee.

SIMPSON ENGINEERING SERVICE IN NEW LOCATION

Harry A. Simpson, owner of Simpson Engineering Service, has announced a new location at 795 Walnut, Memphis, Tenn. The firm was formerly located on 376 South Main St., in the same city.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 59 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by February 28, 1948, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

BALLARD, LEON McG., Air Cond. Engr., Cahn Electric Co. PROPOSERS: E. J. Kearby, W. E. FitzGerald. SECONDERS: Cecil Porter*, G. A. Burton*.

BAPPLER, CHARLES T., Regional Sales Mgr., McQuay, Inc. PROPOSERS: W. J. Osborn, J. M. High. SECONDERS: E. J. Ritchie, R W. Cumming.

BIRCH, FREDERICK W., Mgr., The Elias Rogers Co., Ltd. PROPOSERS: A. S. Morgan, D. H. Butler. SECONDERS: H. B. Jenney, M. W. Shears.

BLAZEK, LOUIS J., JR., Mech. Engr., Ellerbe & Co. PROPOSERS: William Sturm, T. Shimazaki. SECONDERS: J. R. Peterson, J. A. Rudberg.

BROWN, HENRY C., JR., Section Head, Res.. Lab., Armstrong Cork Co. PROPOSERS: E. C. Lloyd, H. E. Lewis. SECONDERS: E. R. Queer, R. H. Heilman.

CLARK, ROYAL J., Estimator B. A. Walterman Co. PROPOSERS: C. D. Weaver, H. K. Jennings. SECONDERS: A. W. Edwards, K. B. Little.

COATES, WILLIAM J., Sales Engr., Sarco Canada Ltd. PROPOSERS: J. H. Ross, R. E. Powers. SECONDERS: E. E. Wells, Raul Roy.

CUSTER, JOHN B., Asst. Engr., Htg. Dept., Coast to Coast Stores. PROPOSERS: R. L. Campbell, M. D. Spanton. SECONDERS: A. B. Algren, Eugene Mathis.

DIE, ROY R., Student, A. & M. College of Texas. PROPOSERS: J. S. Hopper, W. E. Long. SECONDERS: W. E. Rohrabacher, A. V. Brewer*.

DONOVAN, GERARD T., Exec. Sec'y., Heating, Piping and Air Conditioning Contractors Cincinnati Association. PROPOSERS: F. J. Ward, W. R. Stevens. SECONDERS: C. D. Weaver, Jr., F. B. De Bra.

DUMONT, VALMORE, Dumont Plumbing Service, Ltd. PROPOSERS: T. H. Worthington, W. B. Pennock. SECONDERS: J. J. Cosgrave, Leo Garneau.

DYKES, OSBORNE J., JR., Pres. The Dykes Co., Inc. PROPOSERS: E. J. Kearby, W. E. FitzGerald. SECONDER: A. H. Otto, R. M. Hood.

EICHERS, JACK N., Sales, Stevens Sales Co. PROPOSERS: E. V. Gritton, C. E. Ferguson. SECONDERS: D. R. Wilde, A. R. Curtis.

EIGENMANN, ALBERT, Consulting Engr. PROPOSERS: Aldo Gini, Walter Hausler. SECONDERS: B. Goerg, L. F. de Bruyn.

FARRAR, JOSEPH L., Estimator, Lent's Plumbing & Heating. PROPOSERS: R. H. Liniger, C. W. May. SECONDERS: S. D. Peterson, R. O. Wesley.

FIDELI, FRANZ A., Sales Engr., American Blower Corp. PROPOSERS: R. R. Ferguson, W. J. Rothenbach. SECONDERS: W. A. Sherbrooke, C. S. Pabst.

FOLLENFANT, HENRY L. A., Asst. Surveying Engr.., Messrs. Matthew Hall & Co., Ltd. PROPOSERS: J. J. Meyer, Max Isbit* SECONDERS: D. J. Judd*, T. E. Chatterton*.

FORAN, LAVERNE E., Chicago Steel Furnace Co. PROPOSERS: M J. Bamond, E. M. Mittendorff. SECONDERS: E. E. Sundeen, J. F. Tobin.

FRANK, MILTON S., Chem. Engr., Neil H. Peterson Co. PROPOSERS: N. H. Peterson, H. V. Hickman. SECONDERS: D. F. Owens, K. O. Alexander.

GIANOS, THEODORE C., Student, University of Minnesota. PROPOSERS: A. B. Algren, R. C. Jordan. SECONDERS: William Sturm, C. E. Gausman.

HAMMOND, WILLIAM A., Pres., W. A. Hammond, Inc. PROPOSERS: Joseph Davis, M. C. Beman. SECONDERS: J. A. Collins, J. H. Bryce.

HENDERSON, FREDERICK P., District Engr., Frigidaire Sales Corp. PROPOSERS: S. W. Terry, A. G. Foote. SECONDERS: J. M. Marr, H. G. Smith.

HOCHSCHULZ, ALFRED, Owner, Moto Ventilating Co. PROPOSERS: A. H. Blaker, M. J. Bamond. SECONDERS: W. A. Kuechenberg, G. W. Bornquist.

HOOD, ROBIN M., Managing Partner, Shreveport Refrigeration & Appliance Co. PROPOSERS: E. J. Kearby, W. E. FitzGerald. SECONDERS: A. H. Otto, W. G. Free*.

HOPPER, RAYMOND W., Installation & Service Mgr., The Dykes Co., Inc. PROPOSERS: L. D. Parsons, Jr., S. W. Beaty. SECONDERS: J. I. Menefee, D. C. Daniel.

HUGHES, MALCOLM W., Treas., Alfred J. Hunter & Co. PROPOSERS: J. W. Pulte, O. D. Marshall. SECONDERS: T. D. Stafford, J. L. Alexander.

JACKS, PAUL E., Student, Purdue University. PROPOSERS: W. T. Miller, C. F. Warner. SECONDERS: H. G. Venemann*, D. S. Clark*.

JENNY, THOMAS J., Sales Engr., Gulf Engineering Co., Inc. PROPOSERS: Theodore Offner. J. S. Burke. SECONDERS: F. G. Burns, G. E. May.

KELLY, EARL J., Sales Engr., Bailey-Farrell Co. PROPOSERS: R. P. Dickinson, C. W. Davis. SECONDERS: L. O. Johnson, J. H. Schurman.

KRAMER, EARL J., Mgr. Htg. Dept., The Cincinnati Supply Co. PROPOSERS: G. V. Sutfin, O. W. Motz. SECONDERS: W. A. Juergens, Vincent Hotze.

LEIGH, RICHARD S., Project Engr., Chase Brass & Copper Co. PROPOSERS: R. W. Sidbury, R. L. Maher. SECONDERS: S. R. Osborne, L. A. Ward*.

LOKKEN, CARROLL A., Engr., The Trane Co. PROPOSERS: William Goodman, W. H. Feirn. SECONDERS: R. N. Trane, R. H. Anderegg.

MACQUEEN, DONALD, Pres., Donald MacQueen Co., Ltd. PROPOSERS: A. F. Lamontagne, T. H. Worthington. SECONDERS: J. J. Cosgrove, Leo Garneau.

MANGRUM, RICHARD W., Field Engr., American Blower Corp. PROPOSERS: L. G. Miller, C. H. Pesterfield. SECONDERS: W. W. Bradfield, F. C. Warren.

MILLER, JOHN W., General Sales, American Radiator & Standard Sanitary Corp. PROPOSERS: H. C. Day, G. M. Maier. SECONDERS: G. L. Coryell, A. W. Buschmann.

MITCHELL, JOHN D., Sales Engr., Aladdin Heating Corp. PROPOSERS: S. W. Terry, C. E. Bentley. SECONDERS: H. G. Smith, J. M. Marr.

NEWBANKS, NILES N., Skelgas Div., Skelly Oil Co. PROPOSERS: C. V. Werner, P. C. Leffel. SECONDERS: H. A. Atwater, Henry Nottberg, Jr.

PAULSON, WILLIAM D., JR., Dist. Repr., Air Cond. Dept., General Electric Co. PROPOSERS: E. H. Howes, D. L. Williams. SECONDERS: C. D. Williams, O. D. Paulson.

*Non-member.

PETTI, OMER A., Engr., Ford Motor Co. PROPOSERS: J. S. Kilner, R. H. Oberschulte. SECONDERS: Harold Clark, R. D. Randall.
PHELPS, KENNETH G., Mech. Engr., Plant Dept., University of Michigan. PROPOSERS: A. A. Cumming*, H. E. Keeler*. SECONDERS: C. F. Kessler, R. S. Hawley*.
POLIVKA, NORBERT L., Mech. Engr., Electro Motive Div., General Motors Corp. PROPOSERS: V. L. Wesby, J. J. Philippi. SECONDERS: W. A. Kuechenberg, M. J. Bamond.

RECKMAN, WILLIAM C., Sales Engr., Minneapolis-Honeywell Regulator Co. PROPOSERS: Frederick Juer, A. W. Edwards. SECONDERS: I. G. Edwards, W. A. Schoonover.
ROWLAND, JOHN, Supvsr., Minneapolis Gas Light Co. PROPOSERS: R. T. Haley, V. E. Pearson. SECONDERS: E. J. Uhl, R. A. Nelson.

SASSER, JAMES F., Chief Engr., Limbach Tempatrol Co. PROPOSERS: F. C. McIntosh, H. E. Park. SECONDERS: P. A. Edwards, C. H. Schneider.
SCHLENTNER, KARL O., Asst. Mgr. of Res., The National Radiator Co. PROPOSERS: L. N. Hunter, P. B. Holmes. SECONDERS: M. W. McRae, J. W. Pierce.
SETZER, CHARLES M., JR., Sales Mgr., Charles M. Setzer & Co. PROPOSERS: E. G. Embree, A. Z. Price. SECONDERS: W. P. Smith, Jr., M. F. Wooten, Jr.
SHAPIRO, PAUL, Owner, Superior Refrigeration Supply Co. PROPOSERS: W. F. Schreiber, D. M. Allen. SECONDERS: E. E. Ralston, C. W. Schumacher.

*Non-member.

SHEDD, ROBERT W., R. L. Deppmann Co. PROPOSERS: C. V. Saunders, L. G. Miller. SECONDERS: L. A. Calcater[illegible] S. G. McMaster.
SIGEL, ROBERT J., Sales Engr., York Corp. PROPOSERS: F. H. Buzzard, R. H. Ackerman. SECONDERS: E. H. Dafte[illegible] R. H. Smiles.
SILVA, JOAO V. B., Mgr. Air Cond. Dept., Metalur[illegible]a Da Longra Lda. PROPOSERS: J. N. Riley, N. W. [illegible]ney. SECONDERS: C. W. Grigas*, J. W. Sherrer.
SIMON, KENNETH D., Sales Engr., National Air Cond[illegible] Co. PROPOSERS: H. H. Allison, Maron Kennedy. SECONDERS: R. S. Farr, F. B. Gardner.
SMITH, IRWIN, Draftsman, Parsons, Brinckerhoff, Hogan & McDonald. PROPOSERS: E. B. Johnson, F. X. Ficarra. SECONDERS: J. S. Arnold, N. S. Zaleiko*.
SPEAR, THOMAS A., Owner, City Electric Appliance Co. PROPOSERS: Chandler Weaver, Dick Tanner. SECONDERS: W. McC. Larimer, Fred Janssen.
STEVENS, CURTIS H., Sales, Stevens Sales Co. PROPOSERS: E. V. Gritton, D. R. Wilde. SECONDERS: C. E. Ferguson, A. R. Curtis.
STRUWE, JOHN B., Mgr. Indus. Engrg., Southwestern Gas & Electric Co. PROPOSERS: E. J. Kearby, W. E. FitzGerald. SECONDERS: A. H. Otto, R. M. Hood.

TACK, PRESTON B., Sales Engr, Minneapolis-Honeywell Regulator Co. PROPOSERS: C. W. Finn, R. O. Wesley. SECONDERS: C. A. Pangborn, R. O. Granston.
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Candidates Elected

In the past issues of the JOURNAL of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by **Art. B-III**, *Section* 8, of the By-Laws, the following list of candidates elected:

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Western Michigan: Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, Frank Harbin, Jr., 280 E. 6th St., Holland. Secretary, W. C. DeRoo, 500 E. 8th St., Holland.

Western New York: Organized, 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. President, G. E. Adema, 39 W. Balcom St., Buffalo 9. Secretary, J. H. Bryce, 88 E. Girard Blvd., Kenmore.

Wisconsin: Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, J. R. Vernon, 507 E. Michigan St., Milwaukee 2. Secretary, B. M. Kluge, 1817 S. 66th St., Milwaukee 14.

Student Branch

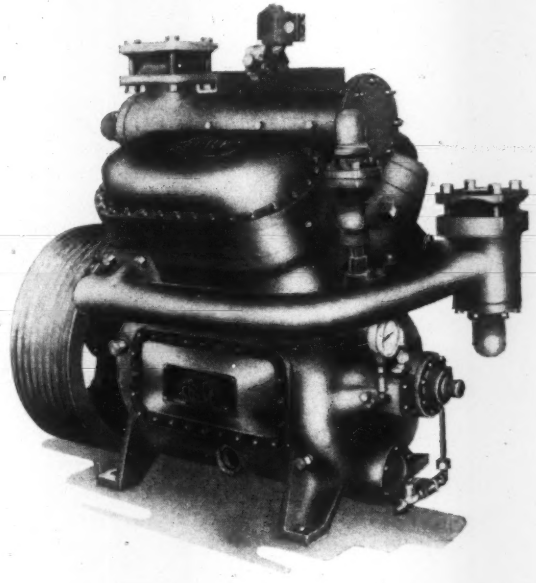
Texas A. & M. College: Organized, 1946. Headquarters, College Station, Tex. Meets, Third Thursday. President, S. E. Ammons, 212 - 13th Ave., No., Texas City. Secretary, C. P. Howard, Box 1706, College Station.

EQUIPMENT DEVELOPMENTS

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1948 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

Improved "Freon-12" Compressors in Production

No. 3674—Frick Co., Waynesboro, Pa., has developed a line of "New Eclipse" compressors for "Freon-12" service. While similar to the company's former machines, the new and improved units are said to incorporate many refinements.



Standard capacities on air conditioning work range from 17½ to 53 tons, and the compressors are furnished complete with main line stop valves, safety valve, v belts, wheel and motor pulleys, oil pressure gage, oil strainer, initial charge of oil, and suction scale trap. Capacity controls and unloaders can be used when desired.

Increased capacity per horsepower and excellent vibration control are said to be outstanding features.

Air-to-Air Heat Exchanger Used in Line of Wound Rotor Motors

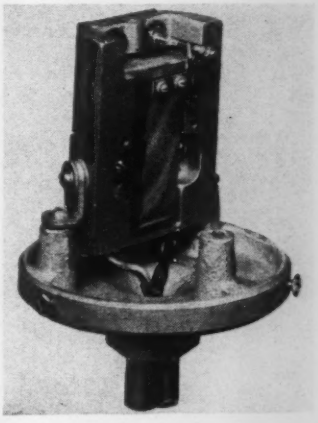
No. 3675—A line of improved totally enclosed, fan cooled, wound rotor motors has been announced by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

The motors are built with an improved tube type air-to-air heat exchanger, first used for squirrel cage motors. The greater efficiency of this exchanger is said to permit a reduction in size compared to older designs, and in addition, its simplicity is said to greatly reduce the necessity for cleaning.

The motors are offered for all fields of industry, since they can be readily adapted to suit the requirements of any special industry. For use in extremely unfavorable atmospheric conditions, the motors can be built with stainless steel ventilating tubes, fans, and end plates, together with cast iron terminal boxes and collector ring enclosures.

Develops Modulating Outside Temperature Controller

No. 3676—Development of a modulating system of temperature control for commercial and industrial buildings has been announced by Minneapolis-Honeywell Regulator Co., 2604 4th Ave., S., Minneapolis 8, Minn. Now in production, the device is designed to regulate inside temperatures in accordance with changes in outside climatic conditions.



Applicable to either hot water or steam heating plants, the new control supplements the "Weatherstat" system now made by the company. The system consists of a new outdoor unit (shown here) with a thermostatic control which is sensitive to changes in weather conditions. The control panel contains adjustments for matching the heating system operation to the design temperature of the zone and the desired temperature level. In addition, a reset controller for setting the position of the pressure or temperature controller is either included in the panel or mounted separately near the modulating valves.

The reset mechanism is also designed to regulate the heat input to compensate for variable heat losses due to wind and sun effects at different outside temperatures. Night shutdown is an added feature of the control panel. While equipment for the new system is now available, the control panels will be constructed on a custom-made basis in order to match the requirements of the individual installations.

Heating, Piping & Air Conditioning **[2-48]**
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature.
(Circle each number in which you are interested)

3674 3675 3676 3677 3678 3679 3680 3681 3682 3683
3684 3685 3686 3687 3688
6754 6755 6756 6757 6758 6759 6760 6761 6762 6763
6764 6765 6766 6767 6768 6769 6770 6771 6772 6773
6774 6775 6776 6777 6778

Name..... **Title**.....

Company .....

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City..... **Zone**..... **State**.....

GIVE YOUR CUSTOMERS THE ADVANTAGES OF FAST RECOVERY...

ON HOT WATER SUPPLY

OVER 40,000 IN USE

ALDRICH HEAT-PAK

ALDRICH FIRE-TUBE WATER HEATERS

Where a hot-water supply system has too slow a recovery rate to take care of residence or commercial demands adequately, an Aldrich Water Heater Unit will often solve the problem. Even the smallest model . . . with a case 20" in diameter and 50" high and a burner rated at 1.3 gph maximum . . . will deliver 125 gph of 140° water continuously. The burner runs whenever necessary to maintain required temperatures. Aldrich Boilers and Burners are matched for maximum efficiency, designed for performance, and built for durability and reliable service.

WIDE RANGE OF CAPACITIES

Aldrich Water Heater Units come in 6 sizes with a rated range of capacities from 125 to 850 gallons of 140° water per hour. All Aldrich units are of the fire-tube type.

ALDRICH OIL BURNERS

The widely-favored, skilfully-engineered, dependable Aldrich Burners are made in 3 types and 5 models with capacities ranging from .75 gph to 19 gph.

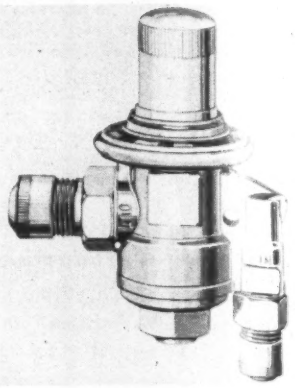
Write today for complete data and price lists

ALDRICH COMPANY

OIL BURNERS • BOILER-BURNERS FOR HEATING AND DOMESTIC WATER SUPPLY

105 EAST WILLIAMS ST., WYOMING, ILL.

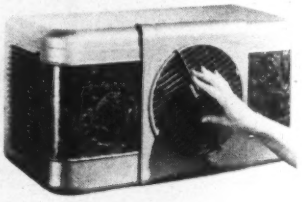
Offers Thermostatic Expansion Valve for Fairly Constant Loads



No. 3677—A new 1 ton automatic expansion valve, AP 304, is offered for refrigeration systems where the load is fairly constant by Automatic Products Co., 2460 N. 32nd St., Milwaukee 10, Wis.

The valve may be used with "Freon," methyl chloride, or sulphur dioxide and has a full range adjustment from 15 in. vacuum to 35 psi. Features are said to include a self adjusting ball type needle, designed to eliminate sliding friction, a stainless steel valve seat, a beryllium-copper diaphragm, copper gaskets, a forged brass body, and stainless steel springs.

Directional Discharge Grille Used on Room Air Conditioners

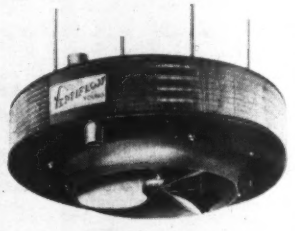


No. 3678*—Fedders-Quigan Corp., 57 Tonawanda St., Buffalo 7, N. Y., is offering new air conditioning units of the window type in ½ and ¾ ton sizes.

These self contained units are equipped with the company's "Airotor" grille which is used to direct the cool air up, down, or at any desired angle. While the units are designed primarily for window sill operation, the directional control of air is said to make possible installation at any height such as in transoms, high windows, and other locations.

Designed to deliver above average capacity, the units cool, dehumidify, filter, and distribute either outside air, recirculated air, or any combination of the two.

Method of Motor Cooling Features Circular Unit Heater Design



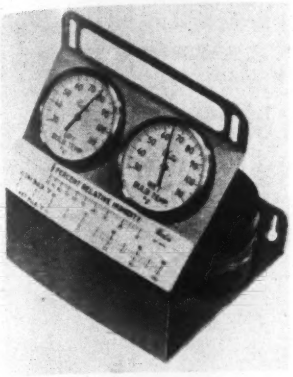
No. 3679—Young Radiator Co., 709 S. Marquette St., Racine, Wis., has developed a new circular, vertical discharge type unit heater to be known as the "Vertiflow" which is said to increase heating efficiency, reduce operating noise to a minimum, and save 35 percent in weight.

The unit features a motor cooling method known as "open-stack" ventilation (patent applied for). By mounting the motor in a stack, which is open at both ends and at the center of the circular heating core, the problem of motor overheating has been eliminated, according to company engineers. Fans draw room air through the open ventilating stack, while at the same time directing the air taken from the heated core downward through the fan opening. This provides

a flow of air around the motor which is said to reduce the motor operating temperature as much as 75 F. When the motor is off, the core heated air rises and, in passing over the top opening of the ventilating stack, forms a natural draft. Thus, cooler room air is drawn up through the stack, thereby providing for continuous cooling of the motor.

The seven models in the line are designed to deliver from 52,600 to 552,000 Btu per hr under standard operating conditions.

Humidity Indicator Measures Wet and Dry Bulb Temperatures



No. 3680*—A new all-metal relative humidity indicator, designed for use in industry and the laboratory, has been announced by Weston Electrical Instrument Corp., 619 Frelinghuysen Ave., Newark 5, N. J.

The instrument, designed to provide readings within ± 1 percent, is of the wet and dry bulb type, featuring all-metal thermometers, a self supporting wet bulb wick covering the thermal element, and a simplified slide rule calculator for obtaining the relative humidity reading directly. The lightweight unit can be swung if desired to create air movement. The only maintenance necessary, says the manufacturer, is to change the wick occasionally and replenish the water in the reservoir.

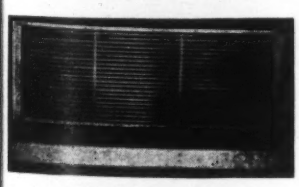
The slide rule calculator, located on the face of the instrument directly beneath the two dial face thermometers, indicates relative humidity from 10 to 100 percent.

Develops Lubricated Plug Valve for Many Industrial Uses

No. 3681**—The H. K. Porter Co., Inc., 1932 Oliver Bldg., Pittburgh 22, Pa., has announced the development and production of a new design of lubricated plug valve which is said to assure complete and leakproof shutoff, elimination of leaks through the stuffing box, ease of operation, and trouble free service.

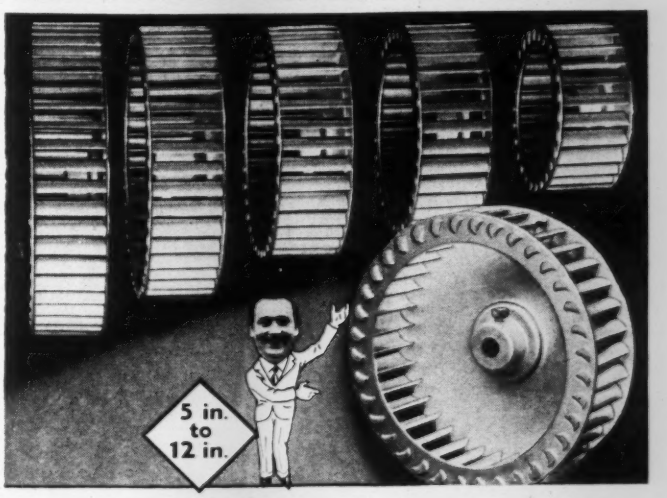
This new design, according to the company, is particularly applicable to manufactured and natural gas operations, refinery installations, oil production, and the chemical and processing industries. The valve is available in semi-steel, carbon steel, alloy and stainless steels.

Develops New Line of Finned Coils for Steam Heating

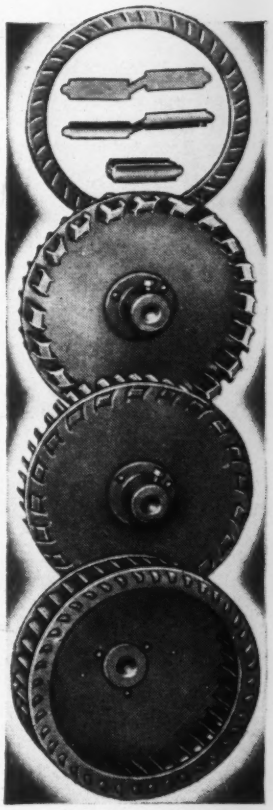


No. 3682**—An extensive line of nonferrous, finned heating coils has been developed by Chicago Fan and Fin Coil Co., 1937 W. Walnut St., Chicago 12, Ill. Coils are available in six, seven, and eight row depths and with tube lengths from 12 to 120 in.

Janette



REALLY STURDY BLOWER WHEELS



...Because of the PATENTED CONSTRUCTION

The steel inlet, back plate discs and slots are die cut to insure exact spacing of the blades, which are formed in pairs to increase rigidity.

A machined aluminum hub is riveted to the back plate, then the blades inserted into the slots.

Each pair of blades are spot welded to the back plate. The inlet disc is then pressed down over the tips of the blades, which are bent against the inherent spring of the steel and then rolled flat against the inlet disc.

Because of this construction JANETTE WHEELS have given universal satisfaction to blower manufacturers for over 20 years.

Why Not USE Them In YOUR BLOWERS?

ASK FOR BULLETIN No. 24-1

Janette

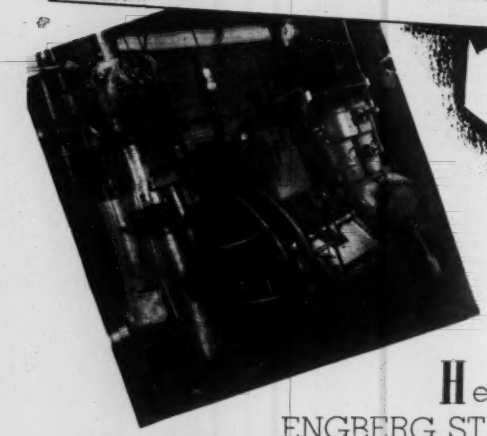
Janette Manufacturing Co. 556 W. Monroe St. Chicago 6, Ill.

TROY-ENGBERG STEAM ENGINE

THE STANDBY DRIVE

that soon became

THE MAIN DRIVE



Here is a TROY-ENGBERG STEAM ENGINE that started out on the second team but just wouldn't stay there! This 10" stroke Type E vertical unit hooked up to a well-known ice machine was installed in SIEBEN'S BREWERY CO., CHICAGO as a standby unit for a large horizontally driven machine. After a test run it was discovered that the TROY-ENGBERG unit could carry the load with the same or less steam consumption than the larger and supposedly more economical unit. Now the TROY-ENGBERG unit carries the full load and the big unit is relegated to the standby status.

If you use steam for heating or processing, you too can probably cut steam costs, which means power costs, by installing a TROY-ENGBERG Steam Engine and using By-Product Power to drive stokers, generators, compressors, pumps or blowers.

Send for Bulletin 306.

TROY ENGINE & MACHINE COMPANY

Established 1870

2200 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG

STEAM ENGINES • GENERATING SETS • GENERATORS

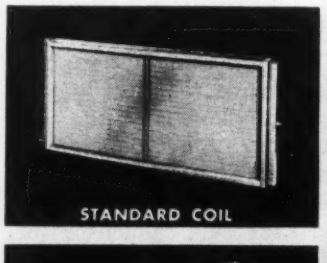
Designed for steam pressures up to and including 200 psi, units incorporate copper tubes which are rolled into cast iron headers. The fins are also of copper and are spirally wound on the tubes, being metallically connected. Corrugated inside shoulders on the fins are said to provide greater contact with the tubes and added strength.

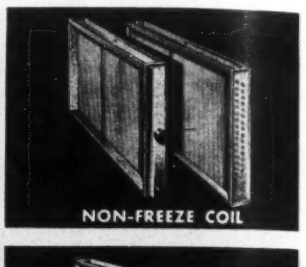
Casings are of galvanized steel with all flanges punched for mounting and installation in ducts.

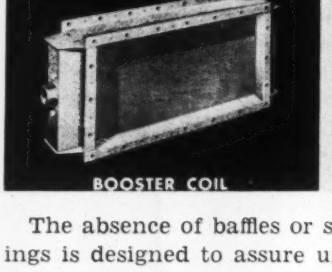
New Line of Heating Coils Features Design Improvements

No. 3683—A broad range of types, models, and sizes plus major design improvements are said to characterize the new line of heating coils announced by Modine Mfg. Co., 1772 Racine St., Racine, Wis.

The new coils are available in standard steam, non-freeze, booster, and hot water types, each in a wide variety of tube and fin combinations and casing sizes.

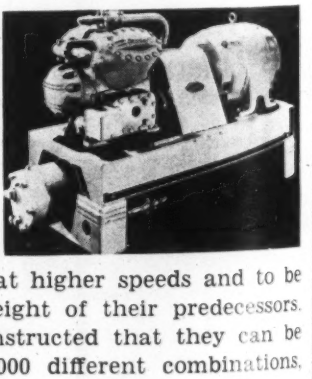






The absence of baffles or shielded headers within casings is designed to assure uniform, unrestricted airflow and low friction loss. Because all surface within casings is heat transer surface, ducts no larger than the coil face area need be employed, according to the manufacturer who also claims higher heating capacity per square foot of coil face area through the use of die formed fins. Coils are of copper and copper alloy throughout. Automatic brazing of all steam carrying passages and metallic bonding of fins to tubes is said to assure long life and continuously high heat transfer capacity.

Refrigeration Compressor Assembled in Many Combinations



No, 3684—A line of "customized" reciprocating compressors, ranging from 5 to 100 hp, has been developed by Carrier Corp., 302 S. Geddes St., Syracuse 1, N. Y.

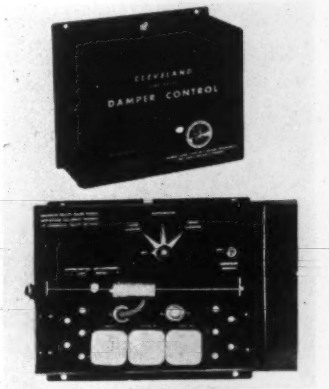
The new machines, designed for either air conditioning or low temperature duties, are said to operate at higher speeds and to be about half the size and weight of their predecessors. The compressors are so constructed that they can be assembled in more than 1000 different combinations.

making it possible to fit the requirements of each installation.

The entire line is so designed that all components—the compressor, the motor, the base, the coupling, and the condenser—can be individually selected to match the specific requirements of the job to be done and the unit can then be assembled on the job without special tools. Users can select either a coupling for direct drive or a flywheel for v belt drive.

Features of the new line include automatic load-free starting, built-in automatic load levelers, external control of capacity, vapor-cushioned valves, removable cylinder sleeves, vapor cooled cylinders, removable bearings, oil cooled shaft seal, automatically reversible oil pump, and magnetic oil drain plugs.

Electric Damper Control Regulates Draft

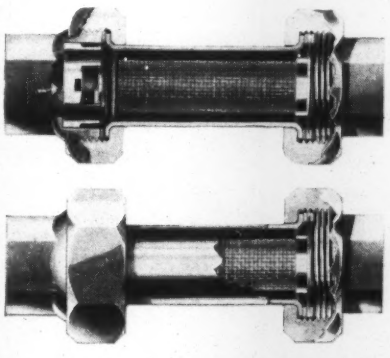


No. 3685 — An electric damper control with automatic time delay features has been developed for controlling the draft on commercial and industrial plants using small and medium size boilers. The manufacturer is Cleveland Fuel Equipment Co., 1836 Euclid Ave., Cleveland 15, Ohio.

Designed for use with stoker, oil, or gas-fired equipment, the control is contained in one cabinet and features a simple differential adjustment, an emergency cutout switch, and an interchangeable application plug for adapting the control to any type of fuel.

For stoker-fired boilers, a relay is energized when the system calls for firing, opening the damper. A second relay starts the stoker when the damper is opened and a third relay places the damper on automatic, modulated control which continues until the start of a new cycle. Operation in connection with gas and oil-fired boilers is similar except that when the burner goes off, the damper is closed to retain residual heat until the cycle is repeated.

Controls Flow of Water, Oil, Gas, or Air



No. 3686* — The "Measurflo" control shown in the upper illustration consists of bronze couplings, a copper tube body, a monel metal strainer, an orifice plate, a rubber diaphragm, and asbestos-neoprene gaskets. It has been developed by Hays Mfg. Co., 801 W. 12th St., Erie, Pa., for maintaining a predetermined flow requirement (water, oil, air, or gas) and is offered for

THIS Automatic FUEL-HANDLING (ap) OILIFTER

BOOSTS SALES ON ALL YOUR VAPORIZING OIL BURNING APPLIANCES

Here's a welcome accessory . . . the A-P OILIFTER . . . that adds greater popularity to Oil Burning Appliances. It ends oil handling in the home, making fuel tank refilling a convenient, safe, clean, *completely automatic* operation.

Easily connected to the oil control on ANY vaporizing burner appliance, the OILIFTER lifts oil from bulk storage tank to one or more appliances as high as the third story, or 100 feet away horizontally. Feeds oil in required amount day and night — with no attention beyond starting in the fall and stopping in the spring. Silent, self-starting motor operates without radio interference. Only a *single* ¼" copper tubing is needed. Listed by UNDERWRITERS' LABORATORIES, INC.

Dealers! Take advantage of this opportunity for extra accessory sales volume! Recommend the OILIFTER as optional equipment on new appliance sales—and tell all your past customers about its benefits, too. You'll build greater enthusiasm for oil heating, increased satisfaction, good will—and greater profits.

A-P OILIFTER with integral filter unit. Can be installed on ANY vaporizing burner appliance requiring oil flow up to 1¼ gallons per hour.

RETURN THE COUPON *for Complete Selling Materials.*

AUTOMATIC PRODUCTS COMPANY
2460 North Thirty-Second Street, Milwaukee 10, Wisconsin
Please send us sales materials and prices on A-P OILIFTER and other A-P Automatic Control Accessories for Vaporizing Burner Appliances.

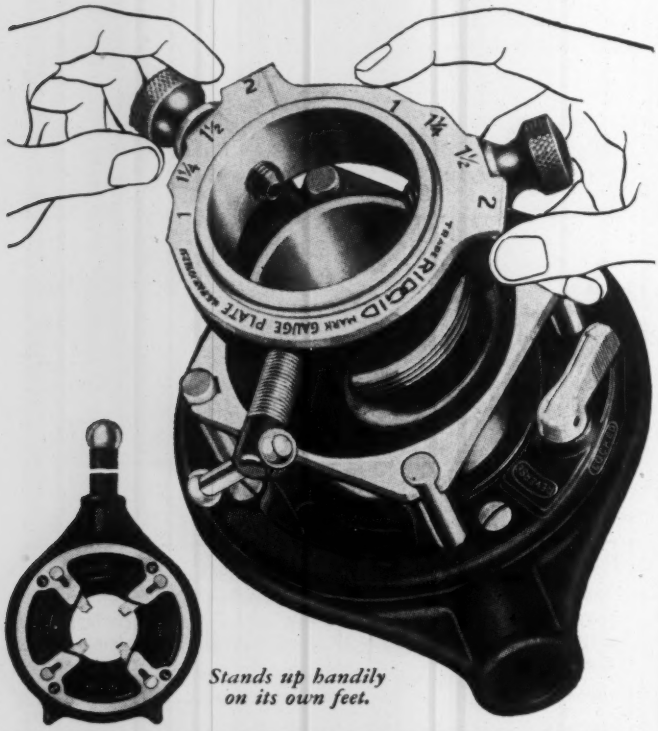
Name.....
Address.....
City.....State.....
Att. of.....
020C

(ap) DEPENDABLE *Oil Controls*
DESIGNED TO ELIMINATE SERVICING

Top Speed
IN POSTER
PIPE THREADING

Extra fast get-ready with this No. 1R RIDGID Threader for 1" to 2" pipe

● If you're partial to poster die stocks . . . here's the one you want. Changing dies is fast as any, but mistake-proof workholder sets faster — only one screw to tighten on pipe, no bushings to monkey with. You'll like the direct-action threading, too — straight line . . . handle to head to dies . . . no wabble. Sets of 4 precision chasers, 1" to 2." Popular price — buy at your Supply House.



Stands up handily on its own feet.

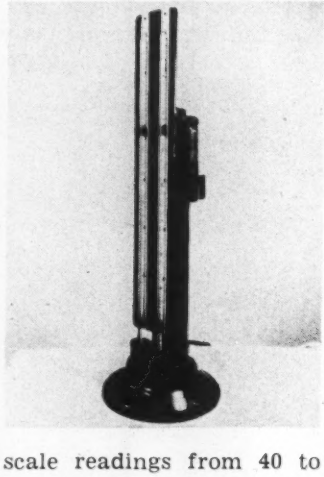
RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

pipe layouts or outlet discharges as specified by the customer.

The rubber diaphragm, solid disc washer is inserted into an orifice or pressure plate, and with increase in pressure, flexes into the grooves of the plate, thereby restricting the opening. According to the company, flow is maintained almost constant over a pressure range from 25 to 125 psi.

The unit shown in the lower illustration is the company's "Straitflo" strainer which is offered for use with steam as well as air, water, oil, and gas. Monel metal screens are available in a variety of meshes and screen areas to meet individual requirements.

Motor Driven Fan Aspirates New Precision Psychrometer



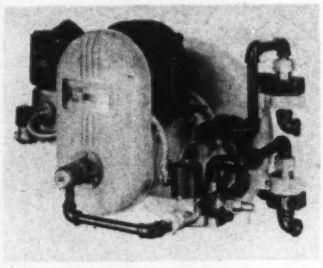
No. 3687* — An electric humidity measuring device believed by the manufacturer to be the most accurate yet developed for commercial and scientific use, has been announced by the Minneapolis-Honeywell Regulator Co., 2604 4th Ave., S., Minneapolis 8, Minn.

Reading temperature deviations within 0.2 deg, the motor driven instrument uses matched wet and dry bulb thermometers with scale readings from 40 to 120 F. Included with the instrument is a large psychrometric chart so that the wet and dry bulb temperature readings may be translated into precise relative humidity percentages.

Called an aspirating psychrometer, the device is designed for use as a standard check for other humidity instruments, for constant temperature rooms, for spot checks, in research laboratories, the dehydrated and frozen food industries, and in a number of other applications where accurate humidity readings are of importance.

The complete instrument, in addition to the psychrometric chart, includes a wick, thread, scissors, a bottle of distilled water, carrying case, and if desired, an adapter over the thermometer bulbs of the matched thermometers so a tube could be inserted into an enclosure, such as duct work, thus obtaining humidity readings by drawing the air from the enclosure by use of the psychrometer fan itself.

Horizontal, Rotary Burner Uses Heavy Fuel Oil



No. 3688** — A new oil burner of the horizontal rotary design, announced by Lieblich Burner Service, Inc., 36 W. 66th St., New York City, is fully automatic and will burn No. 5 or No. 6 fuel oil.

Many "flame shaping" features, says the company, have been incorporated in the design of this burner.

making it particularly adaptable where combustion space is limited.

The range of capacities is from 25 to 500 hp and various current characteristics can be provided for the standard air cooled motors. Burner drive is by twin v belts. Housings are of cast iron and have enamel finish.

Equipment Shorts

A scarcity of "Freon-12" is ahead unless users stop hoarding shipping cylinders or stop sending them out of the country, according to a recent announcement by the manufacturer, Kinetic Chemicals, Inc., Wilmington, Del. The situation is said to be critical for deliveries starting this month and extending through the spring and summer. Return of empties has dropped so low in the last three months that, unless there is an immediate change, production will have to be cut.

Company officials state that raw materials for making the refrigerant are short but not critical and that orders have been placed for new cylinders. However, the steel shortage has prevented delivery in sufficient quantities to solve the problem.

The merger of the Robertshaw Thermostat Co., Youngwood, Pa., the Fulton Sylphon Co., Knoxville, Tenn., and the Bridgeport Thermostat Co., Inc., Bridgeport, Conn., under the name of Robertshaw-Fulton Controls Co. has been announced. The purpose of the merger is to "integrate the development, manufacture, and merchandising of a complete line of automatic temperature controls for household, automotive, industrial, and commercial use," according to J. A. Robertshaw, president of the new organization.

H. S. Marshall, president of the C. A. Dunham Co., Chicago, has announced that a group of Chicago business men, including members of the company's operating and sales organization, have purchased the interests in the company formerly owned by the estate of the late C. A. Dunham, founder. No changes in personnel or policy will result from the sale or are to be anticipated, according to the announcement. The company is a wellknown manufacturer of heat control equipment, condensation and vacuum pumps, convector radiation, unit heaters, and heating specialties, and during 1947 added baseboard convectors and power ventilating equipment.

Attorney General Tom C. Clark has announced that 30 patents on the production and use of electrical apparatus have been made available for unrestricted licensing by the Office of Alien Property, Department of Justice. Mr. Clark said the patents now can be licensed by American business on a royalty-free, nonexclusive basis for an administrative fee of $15.00 per patent.

These patents had heretofore been exclusively licensed in a limited field to certain American companies by their German owners, Siemens-Schuckertwerke A.G. and Siemens-Halske A.G. However, all restrictions on general licensing have now been removed as a result of negotiations conducted by the Office of Alien Property with the American licensees and use can now be made of them in the fields of prime movers and their acces-

YOUR *Pipe Cutting* MADE EASIER

RIDGID Cutter rolls right thru any pipe—it's now efficiency-balanced

● You find it surprising how much the new balanced malleable frame of this RIDGID takes the work out of pipe cutting, helped by its special tool-steel cutter wheel, factory tested to assure perfect circle cutting. Quick and easy does it, as users worldwide can tell you. Choice of 5 sizes to 6" pipe; 4-wheel cutters to 4." Seeing is believing—ask your Supply House.

4-wheel Nos. 42 & 44 for fast quarter-turn cutting.

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WRITE TODAY FOR YOUR
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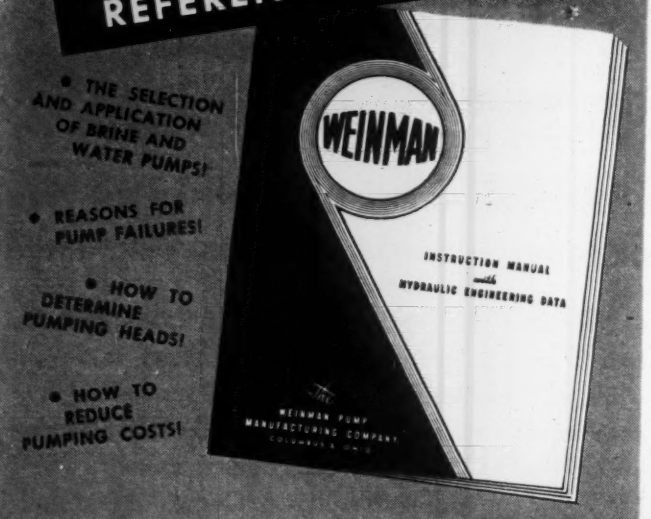
OF THIS VALUABLE
REFERENCE MANUAL


• THE SELECTION AND APPLICATION OF BRINE AND WATER PUMPS!
• REASONS FOR PUMP FAILURES!
• HOW TO DETERMINE PUMPING HEADS!
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INSTRUCTION MANUAL
with
HYDRAULIC ENGINEERING DATA
WEINMAN PUMP MANUFACTURING COMPANY
COLUMBUS 8, OHIO

An understandable and useable compilation of information and instructions pertaining to centrifugal pump applications and operational problems, plus a lot of technical data for engineers. You can't buy this reference manual . . . it's YOURS FREE FOR THE ASKING and without obligation. Write The Weinman Pump Manufacturing Company, 290 Spruce St., Columbus, Ohio.

Illustrated is a Weinman 5" Type L-1 Split-Case Pump. Capacities of 160 GPM to 3,500 GPM . . . heads to 185 ft.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

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Equipment Shorts (Cont.)

sories, and in the control and application of electricity for heat, light, power, and traction purposes. The patents also can be used now in steam turbines, reduction gears, condensing plants, heat exchangers, and certain types of pumps.

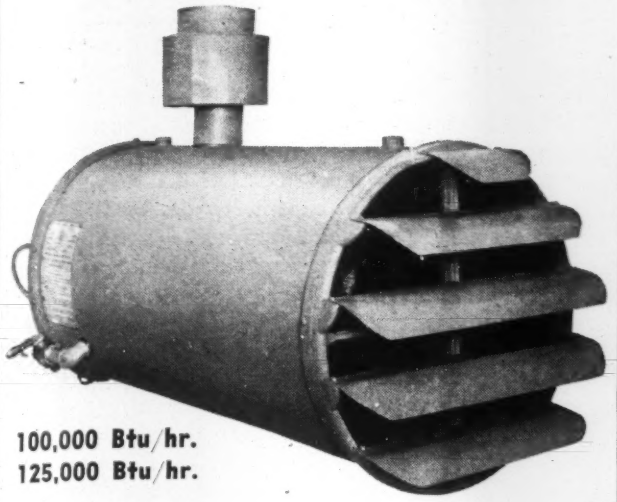
A list of the 60 patents, together with licensing information, can be obtained without cost from the Office of Alien Property, Department of Justice, Washington 25, D. C. Copies of the patents may be purchased only from the Commissioner of Patents, Washington 25, D. C., at 25 cents each.

The Baker Ice Machine Co., South Windham, Me., has completed an agreement with Marlo Coil Co., St. Louis, under which the latter company's line of heat transfer equipment will be available through all Baker offices and distributors. Principal products to be handled by Baker in conjunction with its own line of "Freon-12" and ammonia compressors and equipment include evaporative condensers and coolers, air conditioning units, industrial blower units, and cooling towers, together with other conditioning and refrigerating apparatus.

The name of the Vapor Car Heating Company, Inc., Chicago, has recently been changed to Vapor Heating Corp., according to a recent announcement by A. D. Bruce, president, who said, "since the company's products include the manufacture of heating and temperature control equipment for various types of transportation, the new name is considered to be more suitable." The original organization was formed in 1917 by merging the Chicago Car Heating Co. and the Standard Heat and Ventilating Co. Three years later the Vapor Car Heating Co. of Canada, Ltd. was formed. At the present time the company is manufacturing "Rador" heating controls for railroad passenger cars, air conditioning controls, and steam generators for diesel powered passenger trains.

Taco Heaters, Inc., New York City, is now arranging meetings with heating contractors, wholesalers, architects, and manufacturers of all types of heating equipment for the showing of two new sound slide films. One film, The Four Aces, depicts the advantages of radiant warmth from radiators, convectors, radiant baseboards and radiant panels. Better Heating—Better With Taco is the title of the other film which is devoted, in part, to explaining the IBR method of figuring radiation. The remainder of the film is used to describe the company's forced hot water heating equipment, water heaters, and other products.

Brand Names Foundation, Inc. recently honored the H. B. Smith Co. Inc., Westfield, Mass., by awarding three certificates commemorating long usage of the company's trade names. Brand name "H. B. Smith" has been used to describe cast iron boilers and heating systems for 94 years. Awards were also made for uninterrupted use of the trade name "Mills" since 1870, and use of the trade name "Reed" in connection with boiler grates since 1889.



100,000 Btu/hr.
125,000 Btu/hr.

It's New!

It's Amazing!

This John Zink
UNIT HEATER

This new and unique design in suspended space heaters features: More Head Room—Compact design—More Heat from gas burned, gas company test shows overall efficiency of 82%.

Where floor space is at a premium this turbine type unit has greater heating capacity. Controls are built-in. Unit is shipped completely assembled ready for installation. One unit will heat a 40′ x 80′ space. It is A. G. A. approved for liquefied petroleum gases, manufactured or natural gas.

- **Finished in Toast Tan Crinkle Enamel Baked On**
- **Adjustable Louvers**

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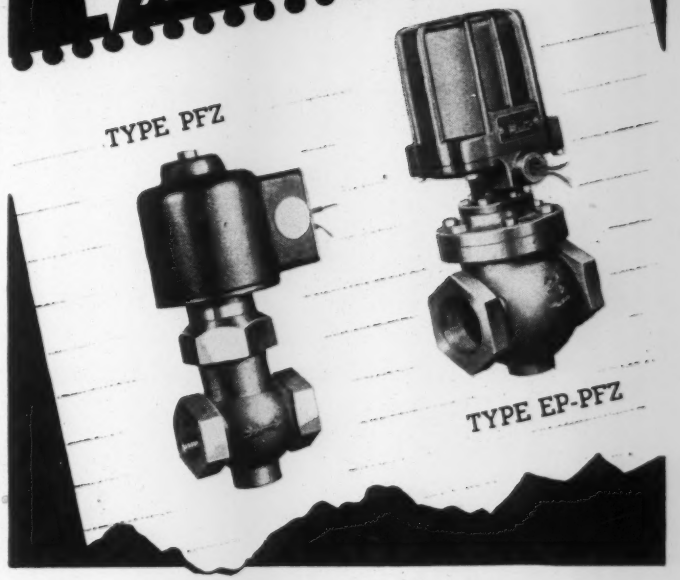
IDEAL VALVES FOR CONTROLLING REFRIGERANT FLOW

Packless *Straight Through* *Full Pipe Area*



The Solenoid Valve serves well both as traffic cop and watch dog for refrigerant lines. Its action is sure and automatic when responding to temperature demands, shutting tight and staying tight or opening full as called for by the system.

The ASCO Line of Solenoid Valves for refrigeration systems is quite varied both as to types and sizes. The two illustrated are widely used; being designed for pressures up to 250 psi and temperatures up to 212 F. Standard valves are bronze with screwed connections. Type EP-PFZ valve is the explosion-proof type with valve construction similar to Type PFZ.

Write us about your refrigerant solenoid valve requirements. We are quite certain we have the valves that will fit into your system perfectly.

ASCO Solenoid Valves

When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

Automatic Switch Co.

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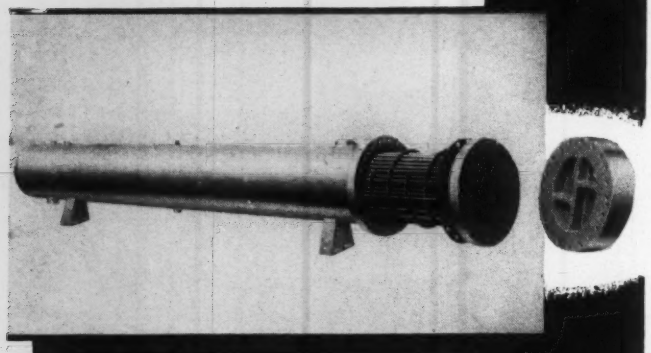
Heat Exchangers
AND
Process Equipment

Heat-Transfer
SPECIALISTS



Specializing
IN REFRIGERANT COOLERS

The very essence of "air conditioning" is the controlled transfer of heat.

It was entirely logical, therefore, that Patterson-Kelley engineers, who have specialized for years in heat-transfer equipment, should turn their attention years ago to refrigerant coolers, condensers and other heat-transfer equipment needed in air conditioning and refrigeration systems.

Today, Patterson-Kelley Equipment, coolers for example, is considered by many to be the standard for such installations.

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THE PATTERSON-KELLEY Company, Inc.
107 WARREN STREET, EAST STROUDSBURG, PA.
NEW YORK 17—101 Park Ave. PHILADELPHIA 3—1700 Walnut St.
CHICAGO 4—Railway Exch. Bldg. BOSTON 16—96-A Huntington Ave.
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EXECUTIVE CHANGES

The election of P. S. Morris as vice president in charge of advertising, purchasing and credit, McQuay, Inc., Minneapolis, and the appointment of H. B. Thomas as the firm's general sales manager has recently been announced. Mr. Thomas, formerly assistant sales manager, succeeds R. C. Colman, who is retiring after 15 years' association with this air conditioning and refrigeration manufacturing firm. He will remain a vice president and member of the board of directors. Mr. Morris joined the company a year ago as assistant to the president and was formerly executive vice president of McQuay Aircraft Corp. and Plxweve Mfg. Corp., both of Los Angeles. Mr. Thomas returned to this country in the fall of 1946 from England where he had been general sales manager of Chronomatic Corp., manufacturers of time control equipment.

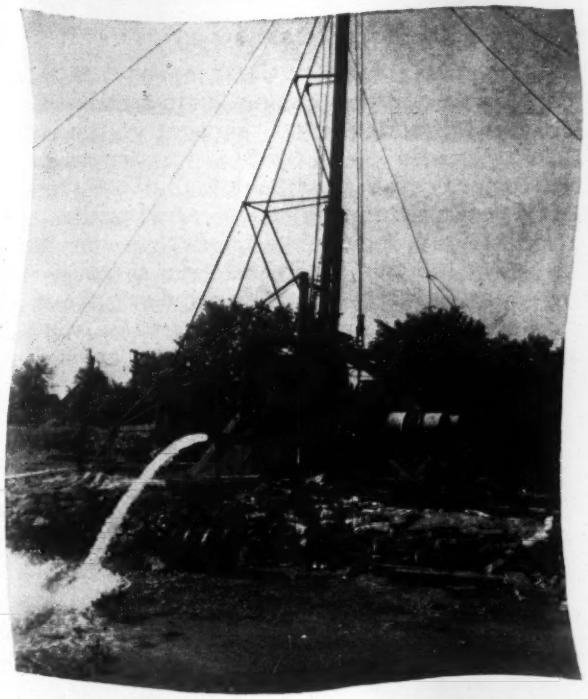
D. F. Coones, controller, who joined the company five years ago, has been named assistant secretary.

Schnacke, Inc., Evansville, Ind., has recently named T. G. "Ted" Thomas as sales manager of its refrigeration equipment division. He replaces Eddy Miller, who resigned to go into his own business. Mr. Thomas had been with the company previously as division manager and has had wide experience in refrigeration sales and engineering as head of his own business in Texas. Other personnel changes recently announced include the appointment of Basil Miller as division manager of the north-central territory and W. H. Hollingsworth as division manager in the northwest territory.

Kinetic Chemicals, Inc., Wilmington, Del., manufacturer of "Freon" refrigerants, has appointed R. J. Thompson director of sales. He was formerly sales manager—technical, and succeeds W. W. Rhodes, who has been named sales manager—aerosol propellants. R. L. Williams has been appointed assistant sales manager—refrigerants.

Calumet & Hecla Consolidated Copper Co. has elected three new vice presidents. They are A. E. Petermann, general counsel, H. Y. Bassett, general manager of the Wolverine Tube Division, and A. H. Wohlrab, general manager of the Calumet Division. Robert Livermore of Boston has retired as vice president, but will remain as a director.

L. B. Smith, vice president and director, A. O. Smith Corp., Milwaukee, has been appointed general manager of the company's Kankakee (Ill.) works. H. F. Detrick, who has held that post since the plant went into production, has been carrying a dual responsibility, according to W. C. Heath, president. In addition to building up the Kankakee organization to a group in excess of 1600 employees, Mr. Detrick has continued to carry on his former duties as president of the Smith Meter Co. of Los Angeles, a wholly owned subsidiary. Mr. Detrick will devote his full-time energies to the Los Angeles firm.



CITY OF ROLLA, MO.

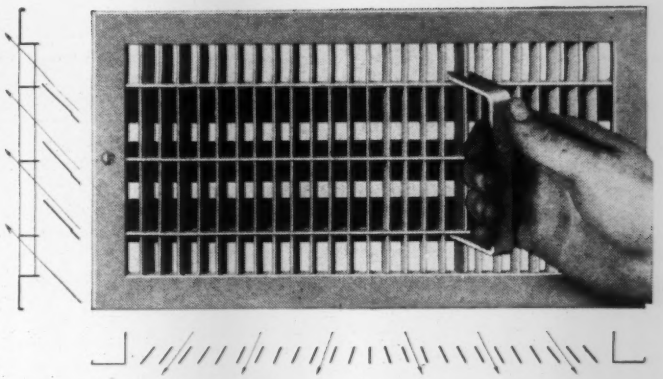
THIS IS THEIR *Fourth* LAYNE WELL

The picturesque and progressive city of Rolla, Missouri, has assured itself of much greater residential, business and industrial growth by adding the fourth Layne Well Water Supply unit, to step their daily water capacity up to 2,500,000 gallons. In purchasing these carefully designed and precision built wells and pumps, the city has made an excellent financial investment. Operating at an unusually low cost, their Water System will show a substantial annual profit. Furthermore, their Layne Wells and Pumps will probably need only very minor repairs for years and years. Layne Well Water Supply Systems, whether installed for cities, factories, railroads, chemical plants, refineries or irrigation projects, can be depended on to give outstanding satisfaction. For further facts, address LAYNE & BOWLER, INC., General Offices, Memphis 8, Tennessee.

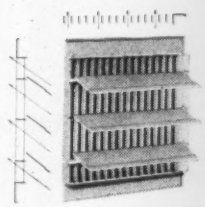
LAYNE WELL WATER Systems

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Washington ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minnesota, Minneapolis, Minnesota ★ International Water Supply Ltd., London, Ontario, Canada ★ Layne-Hispano Americana, S. A., Mexico, D. F.

INDEPENDENT "Fabrikated" WALL GRILLES WITH DEFLECTING VANES



Style 321-A grille with deflecting vanes



Rear view showing adjustable deflecting vanes

ACCURATE and positive compound deflection of air flows can be readily secured with these "Fabrikated" grilles. Directional adjustments may be made when grilles are installed; or grille bars and vanes may be adjusted after installation to meet unforeseen or changed requirements.

Each grille bar and each deflecting vane is adjusted *individually* with a special two-pronged tool included with each shipment. Locking of grille bars and vanes is not required because they are held firmly in place — no vibration — no rattle.

Write for Our New Catalog No. 481

MEMBER NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION INDOOR COMFORT

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.

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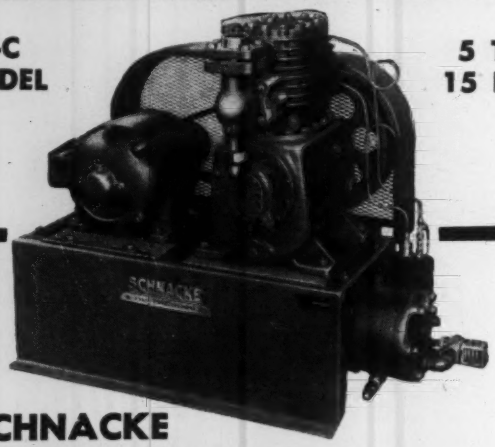
T-C MODEL

5 TO 15 H.P.



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CONDENSING UNITS

For Air Conditioning and Refrigeration

SCHNACKE Compressor has replaceable, refrigerant-cooled steel cylinder sleeves, balanced forged crankshaft, sealed crankcase, complete pressure lubrication, and many other advanced features.

Condenser is ASME approved, fin tube, cleanable type, mounted in sturdy base. Water control valve and pressure control installed. F-C Models 10 to 25 H. P. available. Models less condenser, from 5 to 50 H.P.

Our new foundry now makes deliveries on most models possible in one to two weeks.

Write SCHNACKE, INC., 1020 E. Columbia St., Evansville, Ind., for complete details.

SCHNACKE, INC.

Executive Changes (Cont.)

E. M. Detwiler, assistant works manager of the Buffalo (N. Y.) works of Worthington Pump & Machinery Corp. has been appointed works manager of the company's Holyoke (Mass.) plant, headquarters for production of the company's air conditioning equipment and "Blue Brute" construction equipment. Mr. Detwiler has been associated with the company since November 1929 when he joined the Buffalo organization as plant engineer. He has successively served as standards supervisor, industrial relations supervisor, and assistant works manager. He graduated from Lafayette College in 1927 with a B.S. degree in administrative engineering.

R. C. Yantis, who has been associated with the refrigeration industry for many years, has joined the Henry Valve Co., Chicago, as assistant sales manager. He succeeds G. W. Wilson, who has resigned.

S. J. Rousch, executive vice president of Kerotest Mfg. Co., has announced the appointment of E. T. "Kink" Adams as director of purchases. Mr. Adams has been foreign representative for the company and for 12 years he was purchasing agent of the Sinclair Oil Co., in Mexico.

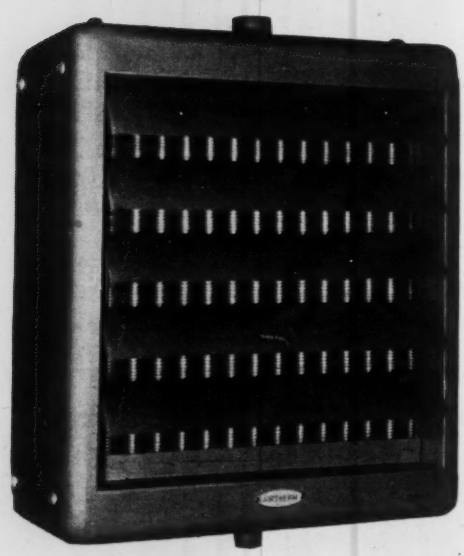
S. A. Rasanen has been appointed credit manager of Harvey-Whipple, Inc., manufacturers of oil heating equipment. He has had many years experience in the oil burner field.

You Can Safely Recommend

AIRTHERM

STEAM UNIT HEATERS

FOR OUTSTANDING PERFORMANCE



1. High over-all efficiency.
2. Attractive in design and rugged in construction.
3. Copper heating elements in floating suspension.
4. Resiliently mounted motors for smooth and quiet operation.
5. Capacities from 26,000 to 274,000 BTU per hour.

There's an Airtherm Steam Unit Heater for every heating application. Write for Bulletin 1206 giving detailed information and range of available sizes.

IT'S WISE TO BUY FROM YOUR DISTRIBUTOR . . .
He's located near you for quick deliveries and better service.

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DIRECT FIRED HEATERS | PROPELLER FAN STEAM UNIT HEATERS | BLOWER FAN STEAM UNIT HEATERS | CONVECTOR RADIATION

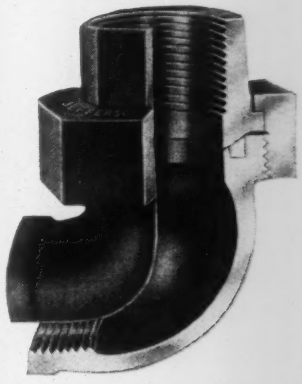
H. E. Degler has been named technical director of Marley Co. Inc., Kansas City, Kans., manufacturers of water cooling towers and other water cooling equipment. He has been professor of mechanical engineering at the University of Texas since 1930, except for one year spent in England with the Army Information and Education Service. He headed the department for 15 years. He also taught for eight years at the University of Illinois and prior to that time was a design engineer for oil and power companies. He has written and co-authored several textbooks on gas, oil, and steam power, and he is a member of several national engineering societies.

A. A. Throckmorton, former deputy director of the War Assets Administration metals division and regional director of the WAA's Region Two in New York, has been named manager of scrap procurement for the Kaiser Aluminum Div., Permanente Metals Corp., Oakland, Calif. He has been identified with the metal phase of the government's surplus disposal program almost since its inception.

Irvin A. "Bus" Eubanks has been named to head the newly created post of supervisor of information, Airtemp Div., Chrysler Corp., Dayton, Ohio, according to a recent announcement by W. C. Newberg, president of the division. Mr. Eubanks, a former newspaperman, joined the division in 1946 as editor of its house organ. The publishing of the dealer and employee magazines will remain under his supervision, and in addition, he will have charge of all informational activities.

IMPORTANT SAVINGS ON PIPING MAINTENANCE WITH JEFFERSON UNIONS

MAKE BETTER PIPING INSTALLATIONS POSSIBLE



Illustrated at right is the 90 degree female union elbow, one of the many Jefferson Unions which will make better installations for you by affording tighter and more efficient piping runs. The brass seating feature in all Jefferson Unions means important savings on piping maintenance because there are fewer joints involved, and the fittings may be made or broken time after time without affecting their efficiency. Expensive shutdowns become things of the past . . . where there are no leaks, there are no reasons for interrupting the service. Investigate today . . . a postcard request is sufficient.

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You Can Recommend with Confidence

FOR PERFECT HEAVY OIL BURNING UNDER ALL OPERATING CONDITIONS

Ace UNIFLOW OIL BURNERS HORIZONTAL ROTARY

Capacity Ranges

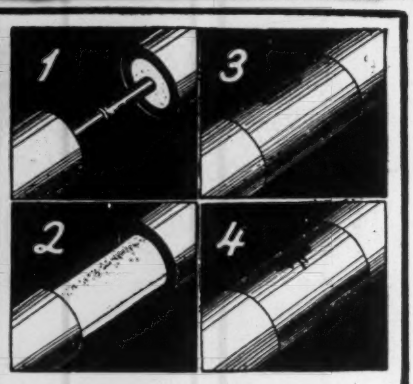
	GALLONS PER HOUR	BOILER H. P.	SQUARE FEET STEAM RAD.
MINIMUM	2	6	800
MAXIMUM	165	500	64,000

ACE ENGINEERING CO.

1435 W. 15th Street • Chicago, Illinois

Custom Engineered Oil Burning Systems Since 1931

Positive Protection



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1. Field joint ready for inspection. 2. Joint covered with standard pipe insulation. 3. Durant joint casing in place ready for asphalt. 4. Asphalt poured in slot making a perfect seal.

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For all your underground and exposed piping jobs you'll like DURANT Pre-Sealed Insulated Pipe. It is waterproof . . . reduces installation costs to a minimum . . . eliminates electrolysis and corrosion . . . requires very little trenching and field work . . . avoids extra cost of waste and breakage . . . comes to you ready to install. In short, D.I.P. is the *perfect pipe* for this type of job. Investgate D.I.P.! Write for details today.

Ready to Install

PRE SEALED

FOR STEAM HOT WATER REFRIGERATION

Trade Mark

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The ORIGINAL Pre-sealed Insulated Pipe

NEW BOOKS & REPORTS

Discusses Industrial Applications of Infrared from Practical Viewpoint

Industrial Applications of Infrared by James [illegible] Hall, advisory engineer, Westinghouse Electric Corp. lamp dept., is written primarily from the practical rather than the theoretical viewpoint. It covers the use of infrared heat in industrial applications by means of the infrared incandescent lamp. In the appendix the gas radiant burner is discussed as a source of infrared. The many advantages of this type heat over other heat sources are likewise fully discussed.

Following a treatise on the fundamentals of heat, the author gives a short history of the lamp as a source of infrared. This is followed by a discussion of the lamp itself—its life expectancy, efficiency, voltage, and its adaptation to higher voltages. Reflectors and reflecting surfaces are also covered, as well as the planning and designing of infrared ovens.

Surface finishing has long been one of the principal applications of infrared equipment. Its importance is recognized by the author who has devoted an entire chapter on paints and other surface finishes. This section deals with the composition of paints and finishes and their reaction to drying or baking by means of infrared. A few of the applications described in the book are: textile manufacturing, ceramic applications, manufacturing of paper, skin mold drying, plastic manufacturing and metal heating. Miscellaneous applications

Positive Performance

MECHANICAL DRAFT TOWERS

For Air-Conditioning and Refrigeration

Predetermined performance for any installation is just one feature . . . but a very important one . . . of Marley mechanical draft towers for small and medium capacity services. The careful capacity rating of these towers is the result of Marley engineering and experience and constant testing in the Marley factory—*not on your job.*

Built for long, trouble-free service life and *fitted to the job,* Marley towers are specified with complete confidence by engineers throughout the Americas.

• **SMALL SERIES VERTICAL**—**Versatile medium capacity tower, may be steel or wood cased, spray or wood filled. Conforms to building codes and harmonizes with architectural design.**

• **AQUATOWER**—**For indoor or outdoor applications, is shipped completely assembled and put in service by making a few simple connections. The case is steel; filling is long-lasting redwood.**

MARLEY WAY is the PERFECT SPRAY

For spraying water, milk, oil, acid, DDT, 2-4D and other fluids Marley Non-Clog Spray Nozzles are first choice of equipment makers and users.

MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

include therapeutics, photography, and plant protection.

This book is well illustrated by means of photographs and charts. There are a few pages devoted to tables on temperature conversions, specific heats, and a bibliography of available literature on infrared.

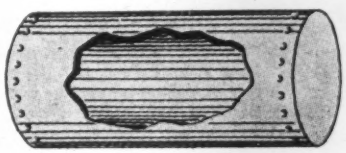
Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y., this 200 page (6 x 9 in.) cloth-bound text is priced at $3.50.—Reviewed by W. M. Woll, assistant supervisor, sales promotion division, Commonwealth Edison Co.

AGA Publishes Proposed Revisions To Standard Requirements

Five sets of proposed revisions to American Standard requirements for gas appliances and accessories have been published by the American Gas Association, 420 Lexington Ave., New York 17, N. Y. Seven technical reports on various requirements investigations have also been completed and distributed to interested committees. The revisions have been sent out to the industry for comment and criticism.

Revised requirements before the industry for comment include gas appliance pressure regulators, automatic main gas control valves, and low water cutoff devices. Some of the completed reports deal with space heaters and water heaters on high heating value butane-air gases, methods for attaching duct work to unit heaters, temperature of unit heater elements, proposed simplification of efficiency tests for warm air furnaces, and technical improvements in the method of test for the operation of space heaters under conditions of a diminished oxygen supply.

NEW LIFE!



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WITH APEX PERMANENT PORCELAIN LINING. Pitted or leaky water tanks can be restored to original usefulness by relining, applied in two coats approximately ¼" thick—cures under water—has an affinity for lime—prevents corrosive and pitting action on metal—withstands temperatures up to 250° without cracking—adds years to life of tank.

RIDAL SERVICE CLEANS

CHEMICALLY STEAM & WATER SYSTEMS. Eliminate sludge and foreign matter from your entire plant safely and economically. We clean and restore to original operating efficiency CHEMICALLY such equipment as: TURBINES — CONDENSERS — STEAM FEED LINES — CONDENSATE RETURNS —WATER HEATERS—STEAM KETTLES—COOLING AND HEATING COILS — PREHEATERS — HEAT EXCHANGERS — EVAPORATORS — TRAPS OF ALL KINDS — ETC.

Consultation Service—Without Obligation

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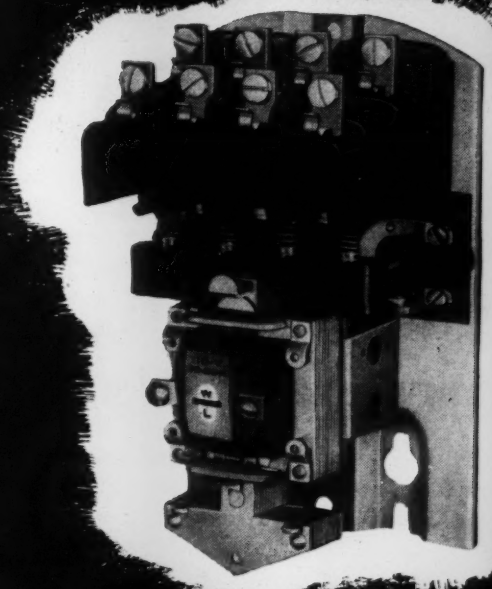


COMPACT construction

New Contactor has maximum capacity for minimum space, and long life

With a minimum of parts, Ward Leonard's new size #1 a-c solenoid contactor is unusually compact. Assembly in your product is simplified by fact that contactor was designed to meet machine tool requirements. Adaptable to many applications where space is limited. Easy to look at, but doesn't need looking after.

Ward Leonard contactors are "Result-Engineered". By modifying a basic design, Ward Leonard can often give you the results of a special . . . for the cost of a standard.

Write for Contactor Catalog. Ward Leonard Electric Co., 24 South St., Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

WHERE BASIC DESIGNS IN ELECTRIC CONTROLS ARE RESULT-ENGINEERED FOR YOU

WARD LEONARD ELECTRIC COMPANY

RESISTORS - RHEOSTATS - RELAYS - CONTROL DEVICES

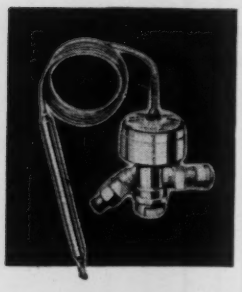
Recognized Dependability

DEPENDABLE...

through years of field proving

Time-tested choice of thousands of manufacturers and engineers since 1940, A-P Model 206 is today one of the industry's top favorites for small tonnage units. Factory set at the desired superheat, it is tamper-proof, and no further field adjustments are necessary — a distinct advantage on many systems. You'll find it on large domestic units, water and beverage coolers, display cases, freezers, air conditioners and similar units.

Like all A-P Expansion Valves, the Model 206 maintains a constant superheat over a wide range of evaporator temperatures, testing less than ½° variation over a range of operating temperatures from minus 30° to 50° F. Popular both as original equipment and as replacement, it is compact, simple to install. Valve body can be mounted in any position or ambient temperature.



NEW MODEL 211 FIXED SUPERHEAT VALVE WITH LIMITING PRESSURE FEATURE

Protects systems against motor overload by limiting operating suction pressure to predetermined setting. May be used in place of any standard fixed superheat valve of similar capacity. Capacity, ½ and 1 ton Freon 12, or Methyl. Types available to limit pressures to 15, 40, and 55 lbs. Freon 12; 10 and 30 lbs. Methyl.

AUTOMATIC PRODUCTS COMPANY

• 2460 North Thirty-Second Street • Milwaukee 10, Wisconsin
Export Department, 13 East 40th Street, New York 16, N. Y.

DEPENDABLE *Refrigeration Valves*

Stocked and Sold by Good Refrigeration Wholesalers Everywhere
Recommended and Installed by Leading Refrigeration Service Engineers

Properties of Refrigeration Brines Given in Data Sheet

Two common refrigeration brines, calcium chloride and sodium chloride are covered in Application Data No. 40 published by the American Society of Refrigerating Engineers, 40 W. 40th St., New York 18, N. Y.

The five page brochure, written by R. H. Stevens, director of technical service, Solvay Process Co., presents in nontechnical terms the properties, preparation and corrosion characteristics of these two widely used brines. In addition, information is given on corrosion inhibitors, brine testing, and the correction for acidity or alkalinity.

Copies of this data section may be obtained from ASRE headquarters for 30 cents each.

AWS Revises Welding Symbols to Include 34 Processes

In establishing the recently revised Standard Welding Symbols, the American Welding Society's committee on symbols has done a major overhaul job on the earlier editions. The 1942 symbols and those in earlier publications, which date back as far as 1929, were concerned only with gas, arc, and resistance welding. This new revised edition covers 34 of the processes used in various industries.

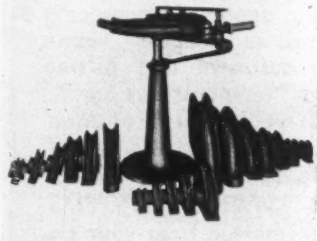
The method of presentation has been revised from a form of rules, as presented in the 1942 standard, to a step-by-step presentation in lecture type form. In addition, the rules have been expanded to include a means of indicating welds having root penetration. Other features include the dropping of the confusing terms,

Use "American"

PIPE BENDING MACHINES . . .

for fast, dependable bends

Radiant HEAT Pipe Bending is simple, accurate with good equipment . . . hand or motor-powered machines available . . . up to 8" capacities.



The Hand-powered "American" A-30

Bends ½" to 2" standard pipe sizes to a radius of 5 to 1, up to 180°. Special radii within these sizes supplied on request. Usual radiant heat bends for 1¼" at 6" & 9" radii can be supplied. Special radius supplied on request.

- Average bend takes only 60 seconds!
- Versatile—bends cold pipe, conduit and tube, copper and brass I.P.S. without crimping.
- 12,000 in use all over the world.

BENT ONCE — BENT RIGHT
ON "AMERICAN" PIPE BENDING MACHINES

American
PIPE BENDING MACHINE
Company INC.

Factory and Main Office: 17 Furnace St., Poultney, Vermont

near side and far side, the addition of 45 illustrations showing applications of the symbols, and a chart which provides a summary of the use of symbols.

Copies of the 1947 issue of Standard Welding Symbols and Rules for Their Use may be obtained from AWS headquarters, 33 W. 39th St., New York City for 50 cents each. The usual discounts to members on individual copies will apply.

Compiles Statistical Record of the Gas Utility Industry

A large amount of data covering the gas utility industry has been assembled for the first time in a single volume called Gas Facts. Completion of this work by the bureau of statistics of the American Gas Association provides a comprehensive statistical record of the gas utility industry in the United States for 1945 and 1946 and marks an important industry milestone in the development of authoritative source material for ready reference. It is the first in a new series of annual statistical year books which will be published by the association.

The book's nine sections and 150 tables give information on gaseous energy reserves; production, transmission, distribution, sales, and utilization of manufactured, natural, mixed, and liquefied petroleum gases; and price, labor, and financial data on the industry. Much of the material is new and all original information is based upon data reported to the association by member companies. In addition to the original data, this volume includes information from other sources which has a direct bearing on the industry.

STEP UP your circulation with AUTO-VENT Air Eliminators

Simple as A-B-C . . . yet positive in action *everytime!* Sure-cure for air pockets and air traps that hold up the free circulation of water or other liquids flowing through pipes — pressures to 75 lbs. Simple in construction—easy to install!

Built of brass with self-closing float operated valve. Withstands high temperatures, oil and other adverse conditions. *Try these No. 7 Auto-Vents once, and you'll use them on every job. They're that good, yet NOT expensive!*

HERE'S HOW TO VENT!

Hot or Cold Water Lines
Convectors
Unit Heaters
Tanks
Diesel Engines
Cooling Manifolds

* * *

IT WILL PAY for you to have information and prices on the complete Maid-O'-Mist line which includes other types of air eliminators, control valves and heating specialties. Write us today, or see your jobber!

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3215 N. PULASKI RD.
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AUTOMATIC HUMIDIFIERS FOR ALL TYPES OF HEATING SYSTEMS

MASTER FLO-CONTROLS FOR STREAMLINED FLOW WITH ACCURATE ADJUSTMENT UNDER CIRCULATION

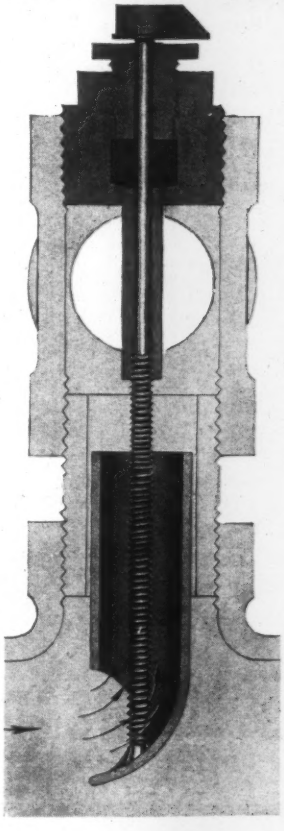
Streamlined Flow Circulates More Water At Less Friction Pressure

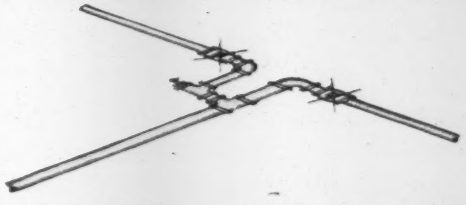
The flow of water is intercepted and directed through the tube into the branches for a 100% streamlined diversion

FLO-MASTER CONTROLS ARE INSTALLED IN CONVENTIONAL PIPE TEES ELIMINATING LARGE STOCKS OF SPECIAL FITTINGS

Each Branch Size of Flo-Master Can Be Installed In Any Size Main—Costs No More Than Stationary Shunt Fittings.

ORDER THROUGH YOUR LOCAL WHOLESALE DEALER





ONE FLO-MASTER ELIMINATES TWO PLUG COCKS
THE ZONE-MASTER for automatic temperature control
THE FLO-MASTER for manual temperature control

Built with the PATENT adjustable streamlined interceptor tube supported by a long threaded adjusting rod for manual regulation during circulation for balanced temperatures

FLO-MASTERS FOR MANUAL CONTROL OF
FLOW TO RISERS FROM SINGLE LOOP MAINS
FLOW TO BRANCH MAINS ELIMINATING PLUG COCKS
FLOW TO RADIATORS FROM RISERS
FLOW TO RADIATORS BELOW ONE PIPE LOOP MAINS
FLOW TO DOWN FEED RISERS

MASTER FLO-CONTROLS ARE THE FIRST TO REGULATE THE FLOW AS A VOLUME STREAM-LINE DAMPER CONTROL — NOT AS VALVES BUILDING UP BACK PRESSURES

The W-M Engineering Company

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TOUGH FLANGES FOR TOUGH JOBS

Drop forging makes Phoenix Flanges rugged . . . positions the grain flow of the metal so that maximum strength and ability to "take it" is the result. Available in a wide range of styles and sizes, all of mild steel especially suited to machining and welding. ASA requirements and ASME and ASTM specifications are met in every case. For details on these tough flanges for tough jobs, get your copy of the Phoenix Flange Catalog. Free on request.

PHOENIX MANUFACTURING COMPANY

JOLIET, ILLINOIS △ CATASAUQUA, PA.

The energy reserve section covers not only natural gas but natural gas liquids, crude oil, coal, and lignite. Under finance, such items as security issues, financial ratios, and construction expenditures are included. Number of employees, payrolls, earnings and hours, as well as accident rates are tabulated in the section devoted to labor. Price data include indexes of consumer prices, fuels and electricity, and retail gas bills.

Copies of this 176 page, paper covered booklet (6 x 9 in.) are available at $1.00 each from the AGA bureau of statistics, 420 Lexington Ave., New York 17, N. Y.

New Material on Heat Engineering Included in Revised Handbook

Since 1908, when first published, Waterbury's Handbook of Engineering has undergone a number of revisions so as to provide more complete engineering and mathematical data. The fourth edition, just off the press, includes for the first time the fundamental principles of heat transfer, the basic principles of illuminating engineering, and the fundamentals of mensuration. In addition, the authors have culled, rewritten, and rearranged the previous contents.

The handbook is divided into five separate sections on mathematics; theoretical mechanics, mechanics of materials, and mechanics of fluids; heat engineering; electrical and illuminating engineering; and mathematical formulas for radio and electronics.

Priced at $2.50 per copy in the United States and $3.00 in Canada, this 386 page, pocket size, clothbound handbook is published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City.

DRY-EX WATER CHILLERS

Materials and welding comply with ASME code. Engineered for chilling water in large volume efficiently.

Back of the product—many years' experience.

Cast steel refrigerant heads are gamma-rayed to assure consistent quality all the way through. Write for complete information.

ACME PRODUCTS

Continuously serving the Refrigeration Industry since 1919. Representatives in principal cities.

ACME Industries, Inc.

Jackson, Michigan

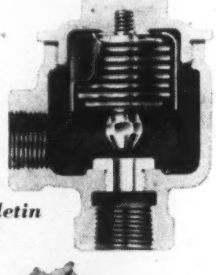
Other Books and Reports Received

Average Monthly and Seasonal Degree Days, revised through the 1945-46 season, published by United States Department of Commerce, weather bureau, division of climatological and hydrologic services, Washington, D. C. The data on the average monthly and average total seasonal degree days are based on 65 F. Information is given for over 200 cities and towns throughout the United States.

Climatic Data for the Design and Operation of Air Conditioning Systems in Florida, by N. C. Ebaugh, head, mechanical engineering dept., and S. P. Goethe, research engineer, University of Florida. Published by Florida Engineering and Industrial Experiment Station, College of Engineering, University of Florida, Gainesville, Fla. Provides information on dry bulb and wet bulb temperature extremes and normals, degree days of the heating season, degree hours of the cooling season, and solar intensities on surfaces having various orientations with respect to the sun.

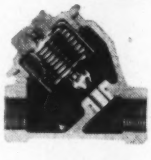
Heat Pump System Using Water Storage, by Philip Sporn, president, American Gas and Electric Service Corp., and E. R. Ambrose, air conditioning engineer of the same company. Published in the Vol. 69, No. 11 issue of Mechanical Engineering by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Describes the operation and performance of a heat pump system employing water storage and using air as the heat source for an industrial control building.

How to Keep Equipment FULL of Live Steam



Bulletin 544

Prompt and full drainage of condensate and venting of air and non-condensible gases are among the most important factors in maintaining maximum heat in coils, kettles, etc. Two reasons why Nicholson thermostatic traps prove superior in test after test: (1) operate on lowest temperature differential, 5° to 15°, depending on trap size and steam pressure. (2) 2 to 6 times average drainage capacity. We'll gladly send one for testing



5 TYPES FOR EVERY APPLICATION —heat, power, process; size ¼" to 2"; press. to 225 lbs. Bull. 544 or see Sweet's.

W. H. NICHOLSON & CO. 198 OREGON STREET WILKES-BARRE, PA.

Valves ★ Traps ★ Steam Specialties

Wherever it stops you'll find Zallea Expansion Joints selected as the ideal medium for absorbing axial and lateral movement due to thermal changes in all kinds of pipelines.

A central heating plant in Iceland, a refinery in Texas, a power plant in India . . . all over the world engineers have selected Zallea Expansion Joints for dependable performance. And here's why . . . **No packing to deteriorate . . . No Maintenance required . . . Longest service life assured.**

There's a Zallea Expansion Joint for almost any application—made of copper, stainless steels or other corrosion-resistant alloys in diameters from 3" upward for temperatures from sub-zero to 1600° F. Available for pressures from vacuum to 300 psi in standard designs and up to 1000 psi in special designs.

You'll want this brand new 60-page Zallea Catalog 47 which describes these joints, their manufacture and how to select the proper expansion joint for your application—all in a profusely illustrated easy-to-read form. Use it as a guide or as a permanent reference source. Write for it TODAY to: *Zallea Brothers and Johnson, 816 Locust St., Wilmington 99, Del.*

Zallea

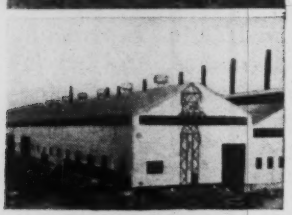
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

TIME

PROVES

Galvanized (ZINC-COATED) Sheets Stay Stronger Longer



34 YEARS . . . Erected in 1913, and covered with heavy gauge galvanized sheets, this Tennessee concentrating plant of the A/Z Company, pictured at left, is still in excellent condition after more than three decades of service. Painted with Gray Metallic Zinc Paint in 1932.

50 YEARS . . . The galvanized metal roof on this old Missouri farm building has outlasted the building itself, and is still in good condition after half a century of service. Industry and the farm have long depended on galvanizing to protect iron and steel against costly rust. Builders know that as long as iron or steel is zinc covered, it *cannot rust.*

In building for the future, look to the past for proof of a building material's strength . . . durability . . . service. With *galvanized* (zinc-coated) roofing and siding you get the strength of steel . . . the rust protection of Zinc. So for low-cost, long-time service choose the building material that's proved by TIME itself . . . galvanized sheets. Send coupon for information about Zinc and how it helps keep buildings and equipment *stronger longer.*

ZINC INSTITUTE 2 OZ. COATING SEAL OF QUALITY

This "Seal of Quality" is your guide to economy in buying galvanized sheets. Sheets bearing it carry at least 2 oz. Zinc per sq. ft.

American Zinc Institute

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FREE BOOKLETS!

Send me without cost or obligation the illustrated booklets I have checked.

- ☐ Repair Manual on Galvanized Roofing and Siding
- ☐ Facts about Galvanized Sheets
- ☐ Use of Metallic Zinc Paint to Protect Metal Surfaces

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MEETINGS & CONVENTIONS

OHI Exposition to be Complete Sellout

With the largest floor space ever taken for a national exposition of the industry's products, the silver anniversary National Oil Heat Exposition is already a sellout, according to R. S. Bohn, president, Oil-Heat Institute of America, Inc., 6 E. 39th St., New York City, sponsor of the show which is to be held at the Chicago Coliseum, April 5 to 8. The institute's exposition and concurrent convention are designed to embrace the entire oil heating field, together with allied industries.

Announces Tentative Program For Midwest Power Conference

The preliminary program for the 10th Annual Midwest Power Conference to be held April 7 to 9, Sheraton Hotel, Chicago, and sponsored by the Illinois Institute of Technology, 3300 S. Federal St., Chicago, has been announced by S. E. Winston, dean of the evening division at Illinois Tech and director of the conference. Some of the many technical sessions and papers covering various engineering fields are as follows:

Session on developments in heating

Panel Heating, Design Procedures, by Prof. F. W. Hutchinson, dept. of mechanical engineering, University of California.

Comparative Performance of Panel and Convection Systems

QUALITY always wins! MARTOCELLO Products are fully DEPENDABLE

ATOMIZING SPRAY NOZZLES, SPRAY POND NOZZLES, and CONDENSER WATER DISTRIBUTORS

For Vertical Shell and Tube Ammonia Condensers

ALL MARTOCELLO SPRAY NOZZLES are manufactured with precision and of a design which has been thoroughly tested for maximum results and durability. They are guaranteed to give satisfaction. Successful, efficient results depend largely upon selecting the proper number, type and size of Nozzles suitable for your installation.

THE MARTOCELLO CONDENSER WATER DISTRIBUTORS are now used as standard equipment by Progressive Refrigerating Engineers in solving their Manpower problem, because they require no attention and assure users of the lowest Condenser Operating Pressures and Minimum Power Cost.

It will pay you to consult us. WRITE or WIRE for further information.

Jos. A. Martocello & Co. 229-231 NORTH 11th STREET PHILADELPHIA 7, PA

Supplying the Ice Industry Since 1916 — There is no Substitute for MARTOCELLO QUALITY

in Research Residence, by S. Konzo and R. W. Roose, dept. of mechanical engineering, University of Illinois.

Session on power plant equipment and appraisal

Selection of Mechanical Draft Fans, by A. P. Darlington, head, mechanical draft div., American Blower Corp., Detroit.

Condensers, their Use and Application in Water-Shortage Areas, by R. J. Martin, dept. of mechanical engineering, University of Illinois.

Session on feedwater treatment No. 1

Causes and Prevention of Condensate-Return-Line Corrosion, by R. T. Hanlon, special service engineer, National Aluminate Corp., Chicago.

The Practical Approach to Modern Boiler Water Treatment, by R. C. Ulmer, technical director, E. F. Drew & Co., New York.

Session on the heat pump

Heat Source Possibilities of the Earth (Milwaukee Area Heat Pump Study), by C. H. Randolph and O. O. Wagley, Wisconsin Electric Power Co., Milwaukee.

Investigation of the Heat Pump for the Chicago Area, by M. S. Oldacre, director of research, Utilities Research Commission, Chicago.

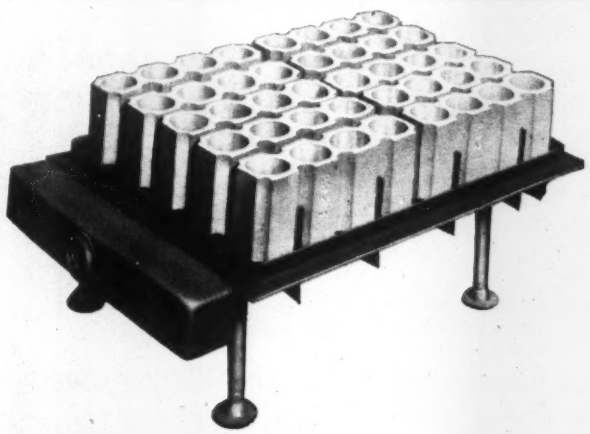
Session on feedwater treatment No. 2

Use of High Alkalinity and Organic Materials for Sludge Removal in High Pressure Boilers, by S. K. Adkins, chemist, Omaha Public Power Dist., Omaha, Neb.

Recent Developments in Boiler Water Research, by F. G. Straub, research professor in chemical engineering, University of Illinois.

Session on fuels and combustion

Experiment on Underground Gasification in the United States, by W. C. Schroeder, chief, Office of Synthetic Liquid Fuels, Bureau of Mines, Washington, D. C.



Install **HANEY GAS BURNERS**

The Haney vertical type venturi burner illustrated above is designed for commercial, domestic or industrial installations and will provide economical, even heat with freedom from upkeep, repair or replacement costs. Investigate now, write for literature.

- *Shipped completely assembled—ready for installation*
- *Adaptable to any requirement*
- *Specified by leading engineers and installing contractors*
- *Available for LP gases.*

HANEY GAS BURNER AND ENGINEERS
909 South Myrtle Avenue Monrovia, Calif.

YOU CAN GET IT QUICKER FROM Stewart

—and Quickly Discover What's Newest in High Velocity Outlets

Fast deliveries are typical of the progressive merchandising policy which keeps the Stewart line of Outlets, Scoopaires, Wall and Baseboard Registers, ahead of the field. Completely re-designed, they offer you and your customers extra advantages in smart, modern appearance, more efficient diffusion and simpler adjustments. You'll find all popular types and sizes in the Stewart line—for air conditioning, heating and ventilating. Or if you require something special, we'll make it.

PROMPT DELIVERIES ON STANDARD SIZES

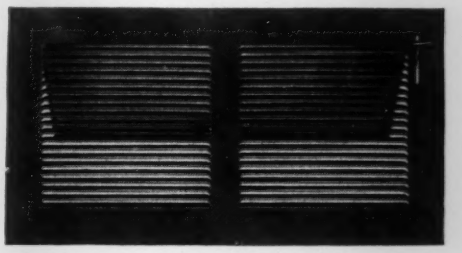
STYLE DDV

(2 Banks) Individually Adjustable Face and Rear Bars

Style DDV is one of 8 variations of Stewart High Velocity Outlets. By means of a detachable key, all bars are adjustable for directing air straight and at various right-left or up-down angles. Style DDV has vertical face bars and horizonal rear bars. Style DDH (not shown) has horizontal face bars and vertical rear bars. This type of outlet is made in popular sizes with or without lever-operated, multiple volume valves. Matching intakes are available. OUTLETS CAN BE SUPPLIED TO FIT CONTOURS OF CABINETS FOR ROOM COOLERS.

STYLE 91

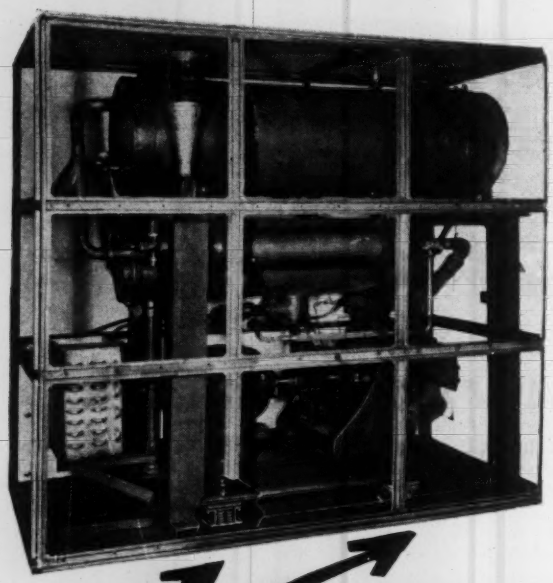
Lever-operated Single Damper Wall Register



STYLE 91 is from the series 70-90 of Wall and Baseboard Registers made with single dampers, or multiple-valve dampers, both lever operated. Face bars of the 90 series are horizontal and set at a down angle. Face bars of the 70 series are vertical, set straight. Setting keys are furnished for user to alter bar settings. Matching grilles are available.

Send for literature and prompt quotation on your requirements

Stewart
MANUFACTURING COMPANY, Inc.
612 BLOOMFIELD AVE., BLOOMFIELD, N. J.



IS *Everything* UNDER CONTROL ?

UNCONTROLLED vibration in compressors, condensers, fans and unit conditioners, can prevent one of the main benefits of air conditioning—silent, unnoticeable operation.

And this silent operation can be obtained so easily! Standard Korfund-Engineered Vibration Control Units include the specially-developed Twin Rail Fan Base and Vibro-Isolators. Korfund utilizes steel-spring, rubber or cork materials to give the exact amount of isolation required.

Over forty-five years of experience in designing vibration control equipment enables Korfund to supply the answer to your vibration problem—and it's both economical and efficient. Write today for more details.

KORFUND VIBRATION CONTROL

THE KORFUND CO., INC.
48-36 32nd Place
Long Island City 1, N. Y.

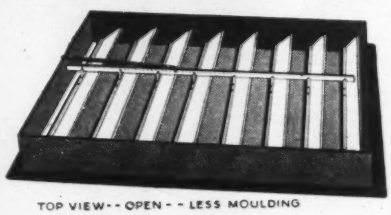
REMA Joins in Sponsoring Refrigeration Exhibit and Conference

Various chapters of the Refrigeration Service Engineers Society have announced their sponsorship of forthcoming exhibits and conferences. In an effort to avoid duplication and to reduce the expenses to which many exhibitors would be put, an agreement has been reached between the RSES and the Refrigeration Equipment Manufacturers Association, 1107 Clark Bldg., Pittsburgh, Pa. The underlying theme of the arrangement is to provide exhibits and conferences for the benefit of those engaged in the installation and servicing of air conditioning and refrigeration equipment who cannot attend the All-Industry Expositions. A series of three or four educational conferences and exhibits will be jointly sponsored by the RSES and REMA during the off-years between the All-Industry shows. One conference is to be held in the south, one on the west coast, one in the east, and possibly one in the middle west or north.

To take them out of the category of trade shows and to make them strictly educational in nature, booths are to be of uniform size, to be provided free of charge, with the cost of the exhibit space being paid by REMA, and are to contain exhibits which are not commercial, being confined to cut-away or table models. All exhibits will be approved by the educational conference committee.

The first of these shows will be the 2nd Annual Western Refrigeration Educational Exhibit and Conference, April 30, May 1 and 2, Palace hotel, San Francisco.

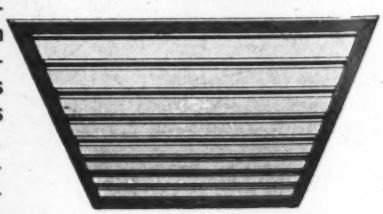
AIR-FLO AUTOMATIC CEILING SHUTTER



TOP VIEW -- OPEN -- LESS MOULDING

FOR ATTIC FANS

Built so they can be installed practically flush with the ceiling, AIR-FLO Ceiling Shutters present a refined, finished appearance. Their natural aluminum color blends with any decoration, eliminating need for painting, and no grille or winter cover is required. Furnished in 5 different widths, single panel up to 73" long. No operating mechanism shows. Built-in fusible link. Meets fire underwriters requirements. Write for illustrated catalog 42-D of the complete AIR-FLO line.



VIEW FROM BELOW -- CLOSED (with moulding)

AIR CONDITIONING PRODUCTS CO.
2340 W. Lafayette Blvd., Detroit 16, Mich.

Dates Set for Second International Store Modernization Show

An attendance of 25,000 retailers and architects from all over the world is predicted at the 2nd International Store Modernization Show, July 6 to 10, Grand Central Palace, New York City, according to J. W. H. Evans, managing director of the show's new advisory committee.

The show is said to provide an important preview of the retail store of the future. A college competition for the Shopping Center of the Future is again to be held among architectural schools and the winning drawings and models will be on display at the show. Invitations for admission can be obtained from the exhibitors or from the Store Modernization Show, 40 E. 49th St., New York 17, N. Y.

Previously Announced Meetings and Conventions

American Institute of Chemical Engineers, 50 E. 41st St., New York City—1948 regional meeting, February 15 to 19, Roosevelt hotel, New Orleans, La.

National Association of Corrosion Engineers, 67 Wall St., New York 5, N. Y.—fourth annual conference and exhibition, April 5 to 8, Jefferson hotel, St. Louis, Mo.

American Foundrymen's Association, 222 W. Adams St., Chicago—52nd annual convention and foundry show, May 3 to 7, Philadelphia Convention Hall.

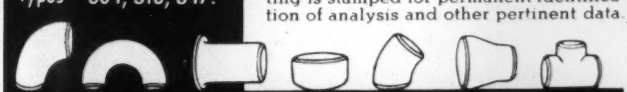
COMPLETE CATALOG

STAINLESS STEEL Welding Fittings

2824 STOCK ITEMS to match pipe and tubing of various wall thicknesses in sizes from ¾" through 12", in three Stainless Types—304, 316, 347.

WRITE for Catalog S-309 which gives specifications and list prices of the world's most complete line of stainless welding fittings, made by specialists having almost two decades of experience in their manufacture.

P.P.&E. stainless welding fittings are made of *forged* or *rolled* stock—no castings are used. The ends are accurately machine tool cut—fittings of wall thickness over .083" are beveled to 37½° with approximately 1/16" straight face; those with wall thickness of .083" or lighter are cut straight, not beveled. The fittings are annealed, blasted, and passivated for maximum corrosion resistance. Each fitting is stamped for permanent identification of analysis and other pertinent data.



STAINLESS ALLOY DIVISION
PITTSBURGH PIPING and EQUIPMENT COMPANY
10 43rd Street · Pittsburgh, Penna.
World's Largest Manufacturer of Stainless Steel Welding Fittings

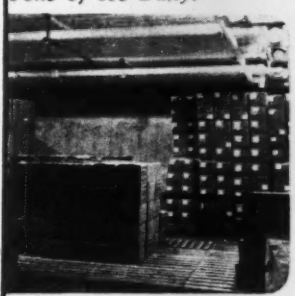
Pratt & Whitney Keep This Room at 68 deg. F, the Year 'Round.

Hold Any Temperature You Want with

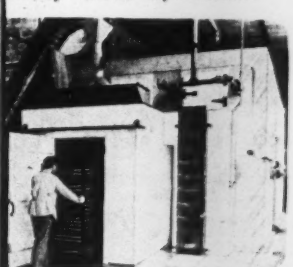
TRADE FRICK MARK

Refrigeration

One-man One-shift Semi-Automatic Plant Makes 42 Tons of Ice Daily.

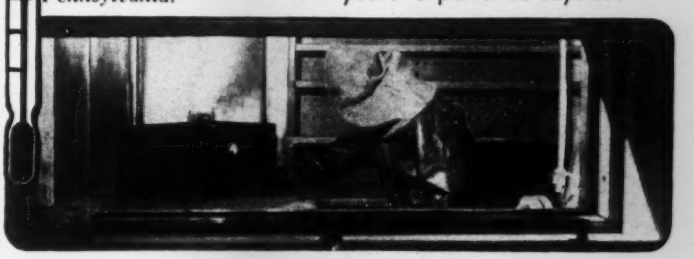


Frozen Foods Stored at –10° F. by Birds Eye-Snider.



Frick-Freezer Tunnel operated at –35° F. at Lancaster, Pennsylvania.

"Cold" down to 130 degrees below zero F. is now common in research and test work. Penicillin is dried at minus 75. Foods are quick-frozen at minus 30 to minus 60: are stored at zero to minus 20. Ice is frozen commercially in brine at 16. Fresh foods are held at 34 to 36. Drinking water is cooled to 45. Air conditioning, at 70 to 85, tops the scale of refrigerating loads. ● Whatever the temperature wanted, you can hold it most dependably with Frick Refrigeration. Sixty-five years' experience says so!



Test at –76° F. in a Refrigerated Laboratory of Bendix Radio.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

BEND COLD PIPE FAST, RIGHT ON THE JOB

with a GREENLEE HYDRAULIC BENDER

Cut costs, speed piping installations this efficient, easy, economical way . . . make "on the job" bends in pipe up to 4½" with a GREENLEE Hydraulic Bender.

Simple to operate, easy to carry, set up, and shift from job to job . . . lets you bend pipe exactly where and when you want it. With a GREENLEE, *one man* makes smooth, accurate, uniform bends in a few minutes. You save greatly through elimination of many manufactured bends and fittings. And, in timesavings alone, the GREENLEE pays for itself quickly.

Ideal for radiant heating jobs, too. For complete details write for free folder S-121. Greenlee Tool Co., Division of Greenlee Bros. & Co., 2342 Twelfth Street, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE

Second Engineering Progress Show, May 11 to 16, Franklin Hall, Franklin Institute of Pennsylvania, Philadelphia—sponsored by the junior members of the Engineers Club of Philadelphia and the Franklin Institute of the State of Pennsylvania.

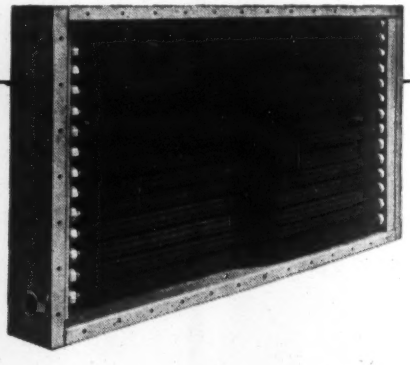
National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6, Pa.—39th annual meeting, May 18 to 21, Hotel Statler, St. Louis, Mo.

Heating, Piping, and Air Conditioning Contractors National Association, 1250 Avenue of the Americas, New York City—59th annual convention, June 1 to 5, Hotel William Penn, Pittsburgh.

Third Annual Home and Building Exposition, June 10 to 20, Pan-Pacific Auditorium, Los Angeles—the show is owned by the Los Angeles chamber of commerce and 14 major construction industry associations of southern California.

National Catholic Building Convention and Exposition, Inc., 185 N. Wabash Ave., Chicago, Ill.—building convention and exposition, June 30, July 1 to 3, Stevens hotel, Chicago.

G&O RADIATION



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FOR HEATING AND COOLING IN A WIDE RANGE OF SIZES

Send for Catalog

THE G & O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 169. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

A-C Generators

No. 6754—How to apply packaged a-c generators is the featured subject in the 16 page Synchronizer, Vol. 8, No. 3a, published by Electric Machinery Mfg. Co., 821 Second Ave., S. E., Minneapolis 14, Minn. Seven tables for generator and wire selection are included.

Arc Welding Electrodes

No. 6755—A 25 by 35 in. electrode wall chart has been published by Hobart Bros. Co., Troy, Ohio. The chart shows procedures for the various electrodes offered by the company and describes the results of too long or too short an arc, too much or too little welding heat, too fast or too slow a welding speed, etc. Welding symbols for both fusion and resistance welding are included.

Automatic Defrosting in Low Temperature Refrigeration Systems

No. 6756—The "Thermobank" system is based on a modified form of the reverse refrigeration cycle and is essentially a combination of a hot gas defrosting system

More Business, More Profit than Ever Before with *UTILITY'S* 1948 Line

11 Models—1150 to 12,000 CFM

Big new sales opportunities . . . Bigger value than ever . . . Smoother, quieter, even more efficient operation . . . Lower installation, operating and maintenance costs . . . Longer life . . . Less servicing. These are some of the features of Utility's 1948 line of Evaporative Air Coolers that mean more installations, more profit per job, highly pleased customers.

Big New DEALER MANUAL Helps You Sell and Install

You get the most complete, the most useful, sales, installation and service handbook ever put together. Gives you just the information it takes to close a deal and figure the installation to assure user satisfaction.

Extra Set of Filter Pads Free . . . with each Utility Cooler. Gives you a premium for prospects.

Get Complete Details on Dealer Franchise

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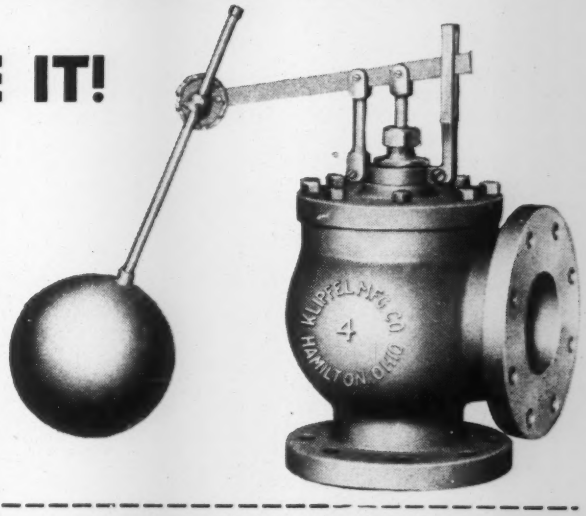
DIVISIONS: Gaffers & Sattler • Occidental Stove Co.

Not looking for trouble....

...BUT ABLE TO TAKE IT!

Klipfel Float Valves—recommended wherever tight-closing is required for open water tanks—assure constant liquid level control at all times.

May we tell you more? Full facts are yours for the asking. Merely fill out and mail the coupon requesting Bulletin 344—a 16-page catalog which describes and illustrates single-seated and double-seated float valves, with information on all types, sizes, dimensions, etc.



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AUTOMATIC REGULATING VALVES

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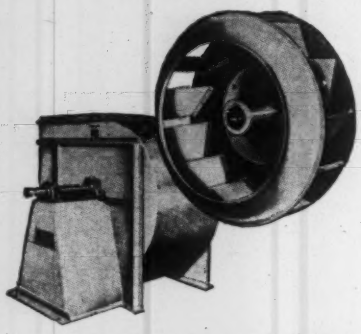

MASSACHUSETTS
POWER FIXED FANS
DESIGN 4
• AIR CONDITIONING •
HEATING &
VENTILATING
• INDUSTRIAL •

Write for Bulletin 101 Catalog

MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
4901 HAMILTON AVENUE · CLEVELAND 14, OHIO

plus a heat accumulator in the suction line. It is designed to provide automatic defrosting for low temperature refrigeration systems. An eight page bulletin (No. R-124) published by the manufacturer, Kramer Trenton Co., Trenton 5, N. J., tells how the system works, describes its advantages, and gives performance data, dimensions, etc.

Axial Fans

No. 6757—An eight page booklet (B-3804) describing the "Axiflo" fans suitable for high temperature applications has been released by Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. Complete with pictures of various models, available in either the elbow or straight-through type, the booklet describes design and construction features which are said to make these positive pressure fans suitable for many types of applications.

Central System Air Conditioning Units

No. 6758—"Frigidaire" central system air conditioning units are described and illustrated in a six page bulletin published by Frigidaire Div., General Motors Corp., Dayton 1, Ohio. Four horizontal suspended models and four vertical floor type models are covered. Nominal capacities range from 5 to 45 tons, and air quantities are from 2400 to 9000 cfm. Design and construction features, together with general specifications, are listed for these units which are designed to provide year 'round conditioning.

Three Cell, Induced Draft Tower, Redwood Construction

Saves Water and Nuisance

Have you ever felt a sudden mist on a clear day near a water cooling tower? That mist is "drift loss" and to reduce this to an almost imperceptible minimum, Offset Herringbone Eliminators are placed near the top of C. H. Wheeler Cooling Towers, as illustrated above. Air conditioning systems with C. H. Wheeler Cooling Towers thus save a maximum amount of water. Send us your specs.; we'll design a tower for your needs with outside casing of wood, steel, masonry or transite, erect it and guarantee results. Bulletin on request.

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REPRESENTATIVES IN MOST PRINCIPAL CITIES

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STEAM CONDENSERS · AIR EJECTORS
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OF PHILADELPHIA

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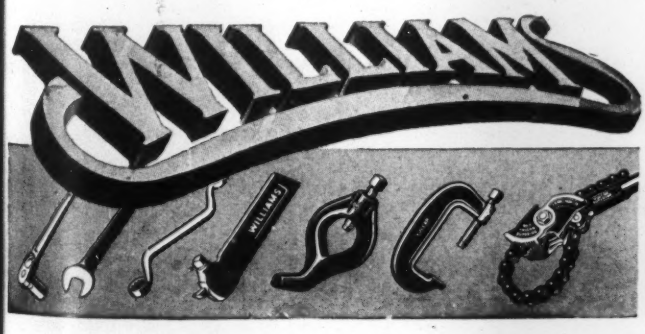
SUPERIOR DROP-FORGED TOOLS

"VULCAN SUPERIOR" CHAIN PIPE TONGS

7 sizes, with either Flat Link or Cable Chain, for pipe and fittings 1/8 to 12".

● **Pipe or fittings—it makes no difference to "Vulcan Superior," the universal service tong. You can switch from one to another without adjustment or change of parts. And "Vulcan Superior" is the only chain tong with *reversible* pipe-and-fittings jaws. When one set of teeth begins to wear, simply remove the Through-Bolt and reverse the jaws. Sold by Plumbing Supply and Industrial Distributors everywhere. Literature on request.**

J. H. WILLIAMS & CO., BUFFALO 7, N. Y.



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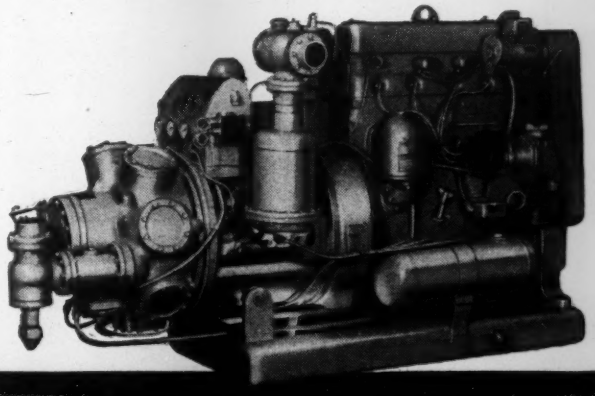
THE ANSWER TO 2 MAJOR AIR CONDITIONING PROBLEMS

1. NO THREE-PHASE POWER REQUIRED

Here is the ideal automatic air conditioning unit for any building located where power facilities are not adequate or where 3-phase commercial power is not available. The unit consists of a modern, radial compressor that is driven by a direct-connected International industrial-type engine. Ready-Power Engined Refrigeration Units are designed and built to give highest quality air conditioning.

2. LOW COST FUELS MEAN LOWEST OPERATING COST

Ready-Power Engined Refrigeration Units use cheap fuels such as natural gas, butane, gasoline or Diesel; therefore operating costs are extremely low. In many cases the costs of air conditioning with Ready-Power are but fractions of what users normally expect to pay. For installations requiring 10 to 75-ton air conditioning load. Write The Ready-Power Co. for complete information.



THE **READY-POWER** CO.

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Calling all JOBBERS!

WHEN TAPPINGS ARE COCKEYED USE
Paracoil
We Stock FLEXIBLE NIPPLES
THEY BEND!
• MAKE TOUGH JOBS EASY!
• SAVE TIME AND LABOR!
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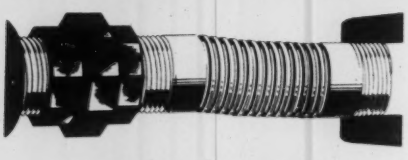
MADE IN 4 SIZES: ¾" x 3"...1" x 4" 1¼" x 4½"...1½" x 5"
THE OLD WAY!
THE PARACOIL WAY!
FLEXIBLE NIPPLE
Manufactured by
DAVIS ENGINEERING CORPORATION
ELIZABETH NEW JERSEY

10" x 14" EYE CATCHING COUNTER CARD

The Fast Selling Paracoil FLEXIBLE NIPPLES



THEY BEND!

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THE "PARACOIL" FLEXIBLE NIPPLES have always been one of the fastest moving items on the jobber's shelves. Every steamfitter and plumber that ever used them knows how they lick the problem of the "cockeyed" tapping, and the out-of-line pipe run. Now available once more, shipments are breaking every previous record!

Helping to keep these fittings moving from jobber to contractor are some of the most striking sales aids ever used for a plumbing or steamfitting specialty. Large 4-color counter cards and explanatory stuffers that stop and sell at a glance, are available FREE to every jobber that stocks these items. They are proven profit makers!

Write today for details—your customers will thank you for handling the line.

Flyers for your counter and direct mail are part of our sales aid.

DAVIS ENGINEERING CORPORATION
1064 East Grand Street, Elizabeth 4, N. J.

Electric Welding Accessories

No. 6759—A new 12 page catalog describing welding electrode holders, ground clamps, cable connectors, machine terminals, cable splicers, lugs, and carbon holders has been issued by Tweco Products Co., P. O. Box 666, Wichita 1, Kans. Quantity price and parts information is included.

Indirect Water Heaters

No. 6760—Diagrams of typical installations, dimensions, specifications, and capacities of "Paracoil" indirect water heaters for commercial, industrial, and domestic use are given in bulletin No. 30, offered by Davis Engineering Corp., 1064 E. Grand St., Elizabeth 4, N. J. The four types of heaters covered are vertical coil, horizontal u tube, tankless, and the unit combining a storage tank and heating element. The company's flexible metallic nipples are also described and illustrated.

Indoor-Outdoor Hot Water Temperature Control

No. 6761—White-Rodgers Electric Co., 1209 Cass Ave., St. Louis 6, Mo., has released a new catalog and a series of application data sheets on its new "Indoor-Outdoor" control for use with radiator convectors and all types of radiant panel hot water heating systems. The unit is designed to provide a means for adjusting the maximum water temperature (under design conditions) to the heating requirements and also to provide for reducing the water temperature in accordance with variations in outdoor temperatures.

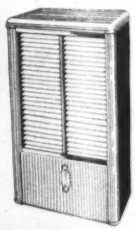
WITH THE **BIG, QUIET FAN**

Where in-rushes of winter make heating a problem, Reznor gas fired unit heaters serve best. The special "heat exchanger" and BIG QUIET FAN of Reznor "automatic" gas fired heaters quickly and economically provide abundant heat.

Distributing more heat per BTU input, Reznor floor or suspended types with thermostatic control are unequaled for bringing economic comfort to homes, apartments, offices, factories, warehouses, garages, stores, restaurants and auditoriums. Write today for details.

SUSPENDED OR FLOOR MODEL
A SIZE FOR EVERY NEED

REZNOR *Gas fired unit heaters*



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GAS FIRED HEATERS SINCE 1888

NO BOILERS • NO STEAM LINES
NO FUEL STORAGE • NO FIRE TENDING

7 REASONS WHY
BINKS "ROTOJET"
SPRAY NOZZLES
GIVE YOU BETTER SERVICE

① **Clog-proof:** Rotojet nozzles are designed to be self-cleaning. ② **Better atomization:** The high centrifugal force developed by the flow of liquid through the nozzle breaks up the water into a perfect spray. ③ **The correct size:** Rotojet nozzles are made with orifices from 1/16 inch to 1 13/16 inches. There is a correct size for your installation. ④ **No moving parts:** There is nothing to get out of order. ⑤ **Longer life:** Extra metal at points of severe wear gives Rotojet nozzles long life. ⑥ **Simplicity of Design:** Rotojet nozzles are highly efficient and easy to install. ⑦ **Satisfaction guaranteed:** Binks guarantees every Rotojet nozzle.

There is a Rotojet nozzle for every spray job

SEND NOW FOR BULLETIN 450 describing these Rotojet nozzles in full

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OFFICES IN ALL PRINCIPAL CITIES

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Streamlined copper tubes combine aerodynamic and heat transfer efficiency.
Deep flanges extruded into headers give abundant tube brazing area.
Individual copper fins have large-area bond to tubes.
Individual tubes "give" laterally to relieve expansion stresses between adjacent tubes.
Full floating element mountings relieve expansion stresses between core and cabinet.
Electrically welded cabinet provides rugged strength.
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